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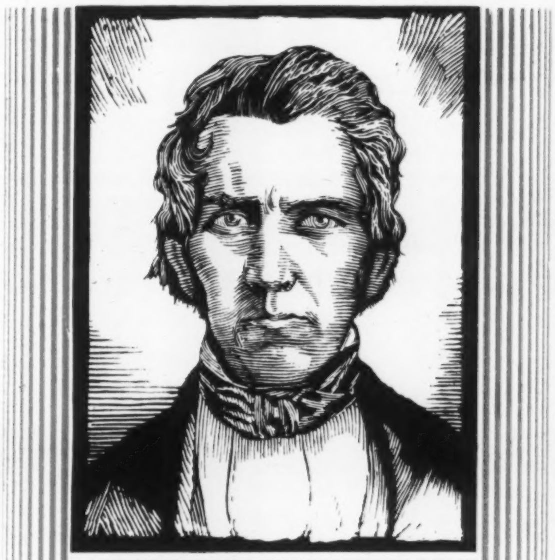
MACHINE DESIGN



Thomas Davenport

AS IT AFFECTS

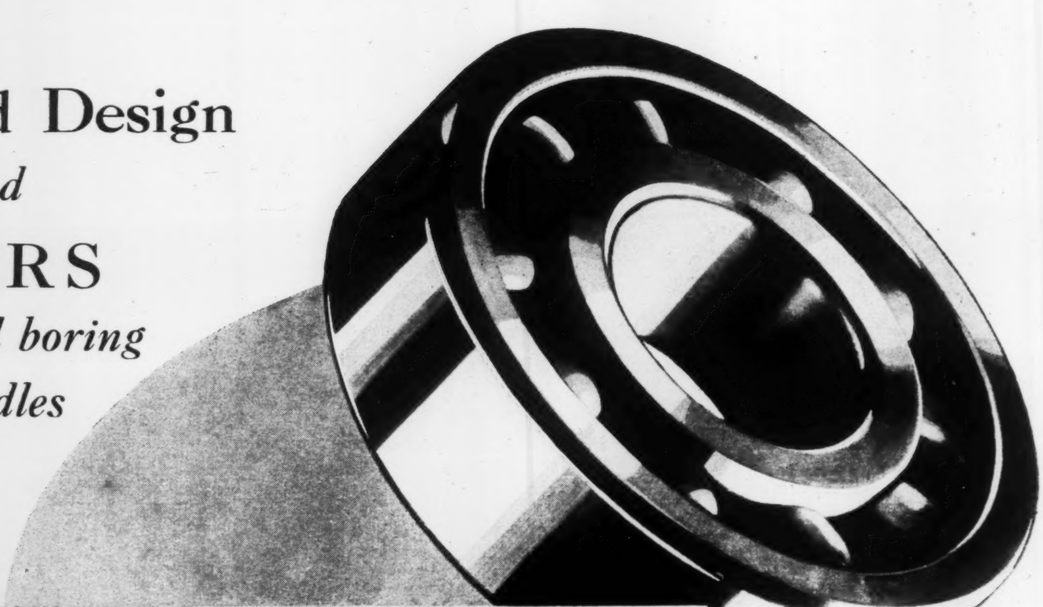
ENGINEERING—PRODUCTION—SALES

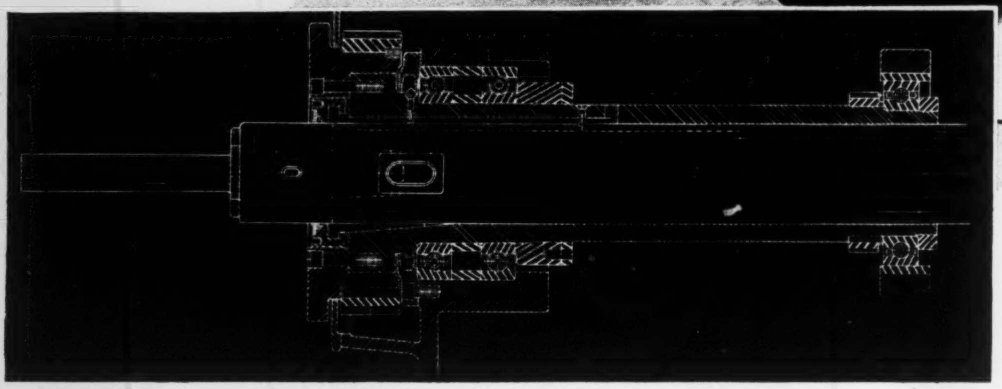
Improved Design

with preloaded

FAFNIRS

for horizontal boring machine spindles





The preloaded "Ohio" spindle. Through the use of spacers the preload is definitely fixed and variations due to the human element in assembly eliminated.

Tungsten and tantulum carbide cutting tools demand faster and more rugged machines for effective use. "Ohio" was faced with this problem in connection with their Single Spindle, High Speed Horizontal Boring, Drilling and Milling Machine. With a maximum spindle speed of 1200 r.p.m., and using a 12″ or 18″ face milling cutter, an anti-friction bearing was needed which could be preloaded for rigidity and still have maximum capacity without heating.

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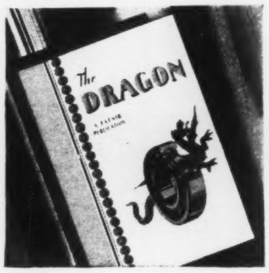

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FAFNIR BALL BEARINGS

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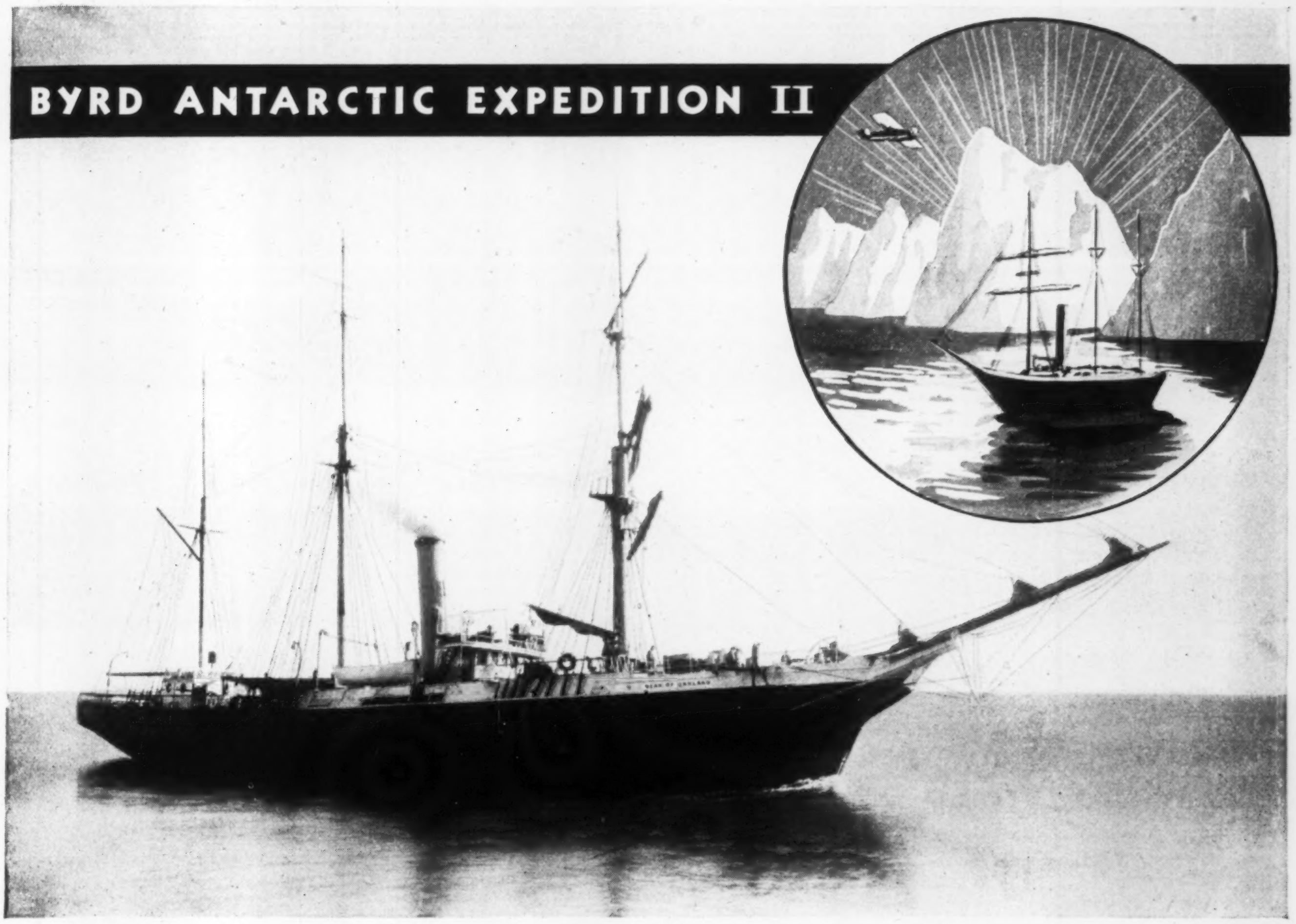

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CALENDAR OF MEETINGS AND EXPOSITIONS

Dec. 4-8—American Society of Mechanical Engineers. Fifty-fourth annual meeting to be held at Engineering Societies building New York. The various groups and organizations planning technical sessions include: Aeronautic, fuels, textile, railroad, iron and steel, oil and gas power, materials handling, lubrication engineering, applied mechanics, hydraulic, management, machine shop practice, steam power and air conditioning. Technical papers will include: "Why Has the Machine Designer Failed to Consider Motion Study?" by Allan H. Mogensen; "Appearance in Design," by Joseph Sinel; "Stress Concentration at Fillets," by A. M. Wahl; "Welded Joints," bv Everett Chapman; "Correlation of Creep Data," by P. G. McVetty; "Investigating the Performance of Bearing Metals and the Wear on These Metals," by J. R. Connelly; and "Fatigue and Mechanical Properties of Spring Material," by D. J. McAdam Jr. Calvin W. Rice, 29 West Thirty-ninth street, New York, is secretary of the society.

Dec. 4-9—Fourteenth Exposition of Chemical Industries. Exhibition of equipment and parts to be held at Grand Central Palace hotel, New York. Charles F. Roth, Grand Central Palace, New York, is manager of the exposition.

Dec. 6-8—American Society of Refrigerating Engineers. Annual meeting at New Yorker hotel, New York. David L. Fiske, 37 West Thirty-ninth street, New York is secretary of the society.

Dec. 6-8—American Institute of Chemical Engineers. Annual meeting to be held at Roanoke hotel, Roanoke, Va. F. J. LeMaistre, 809 Bellvue Court building, Philadelphia, is secretary of the institute.

Dec. 7-8—Taylor Society. Annual meeting to be held at New York. H. S. Person, 29 West Thirty-ninth street, New York, is managing director of the society.

Jan. 6-13—National Automobile Show Thirty-fourth annual exhibition of new designs in automobiles, materials and parts to be held at Grand Central Palace, New York. Exposition is sponsored by National Automobile Chamber of Commerce located at 366 Madison avenue, New York.

Jan. 8—Society of Automotive Engineers. Annual dinner to be held in New York in conjunction with automobile show. John A. C. Warner, 29 West Thirty-ninth street, New York, is general manager of the society.

Jan. 9—Mining and Metallurgical Society of America. Annual meeting to be held at New York. Percy E. Barbour, 75 West street, New York, is secretary of the society.

Jan. 22-25—Society of Automotive Engineers. Annual meeting which will include a program of technical papers to be held in Detroit. John A. C. Warner, 29 West Thirty-ninth street, New York, is general manager of the Automotive society.

Jan. 23-26—American Institute of Electrical Engineers. Annual meeting to be held at Engineering Societies building, New York. H. H. Henline, 33 West Thirty-ninth street, New York, is secretary of the institute.

Feb. 5-8—American Society of Heating and Ventilating Engineers. Annual meeting to be held at Hotel Biltmore, New York. A. V. Hutchinson, 51 Madison avenue, New York, is secretary of the society.

Feb. 5-9—International Heating and Ventilating Exposition. Third annual exhibition of heating, ventilating and air conditioning equipment and methods to be held at Grand Central Palace, New York. Charles F. Roth, Grand Central Palace, New York, is manager of the exposition.

Feb. 19—Technical Association of the Pulp and Paper Industry. Annual meeting and exposition to be held at Waldorf Astoria hotel, New York, R. C. Macdonald, 370 Lexington avenue, New York, is secretary of the association.

March 5-9—American Oil Burner association. Eleventh national oil burner show to be held at Commercial Museum, Philadelphia, will include operating exhibits. Annual meeting of the association to be held at Benjamin Franklin hotel, Philadelphia. Harry F. Tapp, 342 Madison avenue, New York, is secretary of the association.

March 13-16—Fourth Packaging, Packing and Shipping Exposition. Annual display of machines and advances in the technique of modern packaging, packing and shipping under the auspices of American Management association to be held at Hotel Astor, New York. John G. Goetz, 20 Vesey street, New York, is managing director of the management association.

MACHINE DESIGN
THE JOHNSON PUBLISHING COMPANY, CLEVELAND, OHIO
November, 1933 Vol. 5—No. 11

Linkage Gives Positive Action on Cutoff Mechanism

By Norbert C. Rubin

PERHAPS the most popular use of a flying shear cutoff is in combination with a rolling mill, although they have long been employed in the manufacture of paper. Shortly after the sheet metal roll forming machine was put into extensive use a need was recognized for an accurate flying shear to be used in combination with this machine. The problem was to develop a satisfactory cutoff which would be flexible enough to be applied to any roll former. A necessity in the design of the cutoff was that the drive and all motions be absolutely positive and timed to synchronize with the action of the rolling machine. It was for this reason that the design to be described was adopted.

This embodiment of a flying shear cutoff attached to a roll forming machine is shown in Fig. 3. The machine, on which patents are pending, is manufactured by McKinney Tool & Mfg. Co., Cleveland. A coil of stock is shown at the entrance end of the cutoff where it passes into engagement with a set of pinch rolls which feed the stock through the shear and into the rolls of the forming machine. Unique in design are the rear housings of the roll former, a cross section of which appears in Fig. 2. Carried in each rear housing is an individual worm-

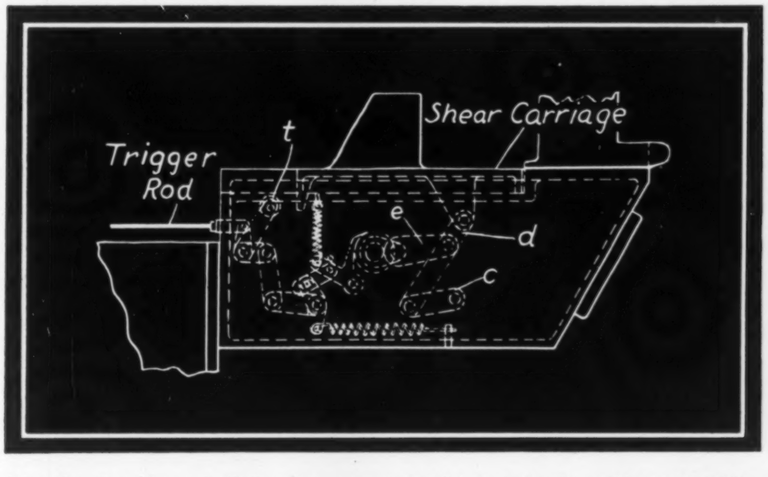


Fig. 1—Crank and link arrangement which acts to reciprocate the shear carriage, also resets the clutch after each revolution

shaft, which, when the assembled housings are secured tightly side by side on the bed, is coupled to the adjacent wormshaft by a rigid steel coupling. This construction makes each housing a separate unit, thus facilitating assembly and disassembly. Another advantage of this design is that it permits the addition of cutoff units wherever required. Plates on both ends of the line of housings serve to retain an oil bath for the worm gear which, by virtue of its rapid rotation, splashes oil into the bearings and on the spur gears.

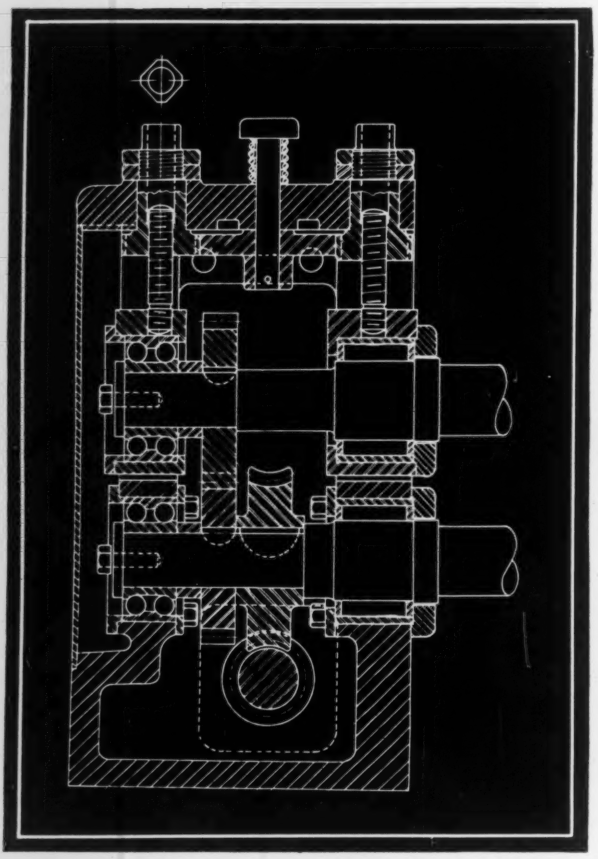


Fig. 2—Individual wormshafts are included in each housing, permitting flexible design

Adjustment Means Provided

As a means of adjusting the vertical position of the top roll spindle for varying thicknesses of material, the slidable bearing boxes which support the spindle carry a stud projecting from their upper surfaces. Having threaded engagement with each stud is a sleeve rotatably mounted in the housing top plate. Formed on the lower end of each sleeve is a small spur gear which meshes with an intermediate spur gear making a three-unit gear train. Therefore, when one sleeve is rotated the other also is rotated, resulting in a parallel maintenance of the upper and lower roll spindles. The coupled wormshafts are rotated by means of an electric motor transmitting its power through a V-belt drive and a clutch.

When a cutoff machine is attached to a roll forming machine, the driving mechanism of the forming machine must be tapped to provide a drive for the cutoff. It would be possible to drive the cutoff through a separate variable speed motor, but the cost of this motor and its control, makes the former design more practical. The necessity of an absolutely positive drive eliminates consideration of belts or similar parts. In the machine herein described, the wormshaft in the housing adjacent the cutoff machine is provided with a coupling to impart rotation to a wormshaft located in the cutoff machine housing.

Cranks Reciprocate Carriage

Engaging the wormshaft is a wormwheel keyed to a shaft with a spur gear which in turn imparts rotation to gear *a* freely mounted on a crankshaft, Fig. 5. Fixed to this gear is a clutch ring, *b*, which serves as the continuously rotating or drive member of a roller clutch having a keyed relation with the crankshaft. Formed on this crankshaft are three cranks, the center crank acting to reciprocate the shear carriage, and the two outer cranks acting to operate the shear itself during the forward reciprocation of the carriage.

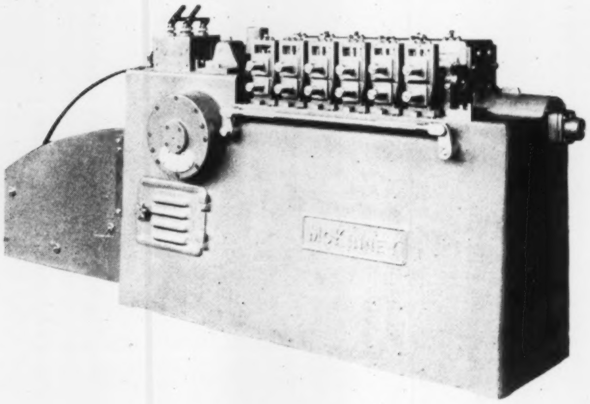


Fig. 3—Flying shear cutoff is designed to operate only when material is of exact length

Fig. 1 illustrates the crank and linkage arrangement for reciprocating the carriage. Pivotally mounted on a fixed pin is link *c* which carries another pin in its opposite end. Another link, *d*, is pivoted to a lug which is part of the shear carriage. The opposite end of the link is mounted on a pin in link *c*, Fig. 1. Mounted on a pin located intermediately with the ends of link *d* is the connecting rod *e*, its opposite end being journalled on the center crank of the crankshaft, also shown in Fig. 5. During one revolution of the crankshaft the carriage will be given a single reciprocation. While the forward movement of the carriage is not absolutely uniform, there is a period of that travel in which the shear is operated when the movement is close enough to uniformity to operate the shear satisfactorily and make a clean, square cut on any thickness of stock within the capacity range of the shear.

The crank and linkage arrangement for operating the shear itself is shown in Fig. 6. In this particular unit the lower shear blade is fixed in the carriage and the upper shear blade is mounted for vertical reciprocation. Pivotally mounted on a fixed pin, *f*, in the top shear blade support is one end of link *g* which terminates on another pin on beam *h*. One end of this beam is journaled on a lug which is part of the shear carriage, while its opposite end carries a pin. Pivoted on this pin is link *k* which has its opposite end pivoted on another pin. Attached to this last pin is a connecting rod *m*, which is journalled on one of the outer cranks of the crankshaft.

Link Arrangement Duplicated

Pivoted on the connecting rod is one end of link *o*, Fig. 6, which has its opposite end pivoted to a fixed pin. This arrangement of links is duplicated for the other outer crank to eliminate any overhang of pin *f*. Upon a single revolution of the crankshaft, the shear blade is moved down and then up during the forward travel of the carriage and then remains in an elevated position during the return travel of the shear carriage. A distinct advantage in this design is the leverage gained by the positioning of the pins in beam *h* without interfering with the operation of the shear itself.

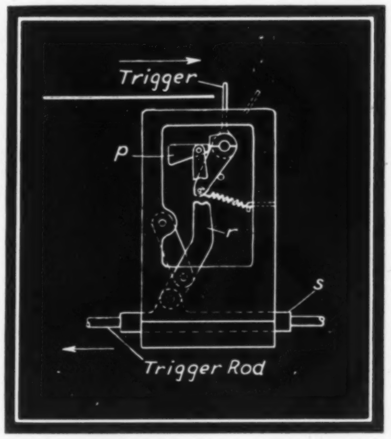


Fig. 4 — Trigger mechanism accurately measures length of piece before it operates the shear blade

An important advantage gained by the use of this mechanism over a cam-operated mechanism is that by using a crank as the driving means a smooth acting reciprocation is obtained which is positive in both directions, whereas the cam mechanism requires a spring or counterweight return or a double-acting cam, an expensive construction. Furthermore, a crank is usually more easily machined than a cam which in this case would have to be contured very accurately.

The pinch rolls and their associated drive mechanism comprise a novel mechanical arrangement in that the pinch rolls rotate continuously while the actual cutoff is being made, and immediately after the cutoff the pinch rolls are momentarily stopped long enough to create a space several inches long between the ends of the severed stock. The function of this space will be referred to in the following.

As a means of creating this space, a gear train has been provided which is driven by a continuously rotating gear. In the gear train are two gears mounted side by side on a common fixed shaft, one being a driver and the other a driven member by virtue of a jaw clutch located between the two gears. Keyed to the crankshaft, which is normally stationary, is a member which, when the crankshaft is rotated one revolution, effects the disengagement of the clutch for a short predetermined length of time after which the clutch is re-engaged and the driven gear again rotates. As the pinch rolls are driven through this particular pair of gears, it is apparent the rolls will stop rotating for the length of time that the clutch is disengaged.

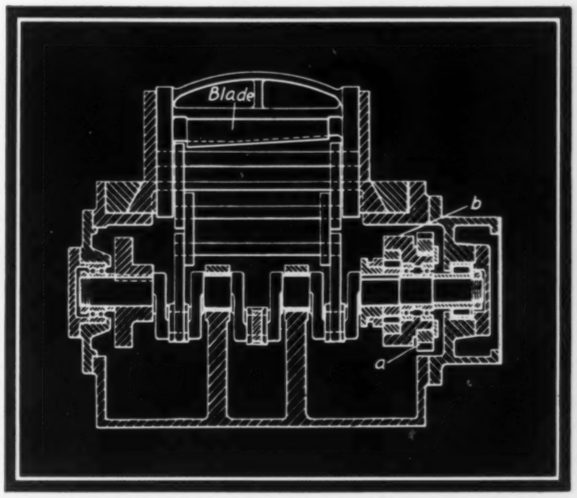


Fig. 5—Clutch ring serves as a continuously rotating member of a one-revolution clutch

Positive Drive Required

Cutoffs often are designed so that the blade operates at regular intervals, but this procedure may introduce inaccuracies as slight errors in adjustment will accumulate. Therefore it was decided to operate the blade on this machine by a trigger mechanism which will actually "measure" the stock before it is cut. Adjustably mounted between any two pair of rolls in the roll forming machine is the trigger, Fig. 5. Supporting the trigger mechanism is a housing pivotally carrying the trigger itself which is definitely located by means of a stop pin and a tension spring. Pressing against a detent on the trigger hub is dog *p* mounted on link *r* which is attached to block *s* which slides in the housing. Acting as a pivot for link *r* is another link which is pivotally mounted in the housing.

Clamped in the sliding block is a trigger rod which by means of a spring is forced in the direction of the lower arrow, Fig. 4. This direction of force tends to press the dog against the detent on the trigger hub. It is apparent that when the trigger is moved into the position shown by the dotted lines, as would be the case when it is contacted by the moving stock, the dog would be released from the trigger hub, allowing the sliding block and its associated trigger rod to be moved in the direction of the lower arrow. This arrangement of links permits a heavy pull to be exerted on the trigger rod while it only requires a small amount of effort on the trigger to release the sliding block.

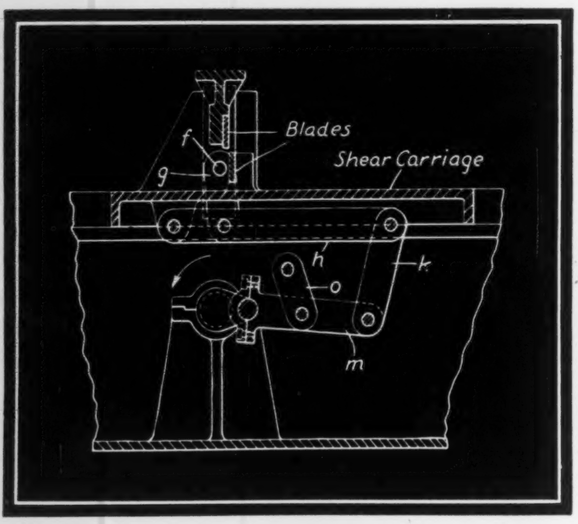


Fig. 6—An advantage of this design is the leverage gained by the positioning of pins

Trigger Governs Rotation

Again referring to Fig. 1, the trigger rod is shown terminating in a clevis which enters the cutoff housing and pivots on one end of a short lever which is keyed to a shaft along with another lever. Through a continuous arrangement of links, a pivotally mounted clutch detent, which coacts with a tooth on the clutch ring to effect the engagement of the previously mentioned roller clutch, is connected to the trigger rod. Also connected to this train of links is a heavy tension spring so arranged that it tends to pull the clutch detent out of engagement with the tooth on the clutch ring and to pull the trigger rod towards the cutoff housing.

Another member of the link arrangement, Fig. 1, carries a roller, *t*, which contacts the shear carriage during that reciprocation and acts to reset the entire trigger mechanism and the associated linkage system in its original position. In operation the clutch driving member rotates continuously, and when the clutch is engaged by virtue of the stock contacting the trigger and releasing the spring to move the clutch detent the crankshaft is rotated one revolution, performing the desired cutoff operation.

One Revolution Clutch Used

The rotation is held to one revolution as the clutch detent is reset during that revolution and contacts the tooth on the clutch ring as it completes its 360-degree cycle. The heavy spring is used to release the detent and engage the clutch so that the most rapid and instantaneous engagement possible can be had which increases the accuracy of the cutoff itself.

Lubrication plays an important part in the accurate functioning of this flying shear cutoff as, obviously, any retardation or lagging of the working parts would tend to disrupt the timing cycle of the machine upon which the accuracy is dependent. Therefore, the housing is built to provide an oil bath into which the cranks and gears dip, and these parts splash oil into any bearings that do not come within reach of the oil level. All ways for reciprocating members are provided with felt inserts from which run channels to a suitable oil cup. A few other bearings which are inaccessible to the oil bath are lubricated through an ordinary grease gun fitting and a length of copper tubing leading to the bearing.

Materials Are Important

It has been found that materials also prove to be a very important factor in this machine as the accuracy in the length of cutoff is dependent on the smoothness of operation and uniform wear on all working parts. For this reason all the gears, shafts and pins are made of a high carbon steel and hardened and ground. The links and levers involved are of ordinary machine steel and those of unusual shapes are of welded construction giving a light and strong piece.

Most of the levers and links pivot on bronze bushings and although they require lubricating attention they have proved quite satisfactory. All the other working parts are mounted on antifriction bearings. The large cutoff housing itself is of cast iron as the number of internal lugs and bosses required made the use of welded construction impractical. However, as the ways in the housing are of cast iron the shear carriage can be of welded construction with cast iron or bronze liners as are the ways for the vertically reciprocating shear support which also employs welded steel plate for its construction.

From a standpoint of appearance, the best results have been obtained by leaving all machined surfaces with a bright polish and coating the other surfaces first with a filler and lastly with a coat of machine gray paint.

SCANNING THE FIELD FOR IDEAS

A Monthly Digest of New Machinery, Materials, Parts and Processes, with Special Attention to Significant Design Features and Trends

A Nose That Smells Electrically

NOW comes the "electric nose" to augument the electric eye which has been holding the attention of engineers for the past several years and incidentally gives no indication of releasing its grip. The research laboratory of the General Electric Co. developed the highly sensitive detector which lights a red lamp and rings a gong when it "smells" mercury vapor, Fig. 1. Only a faint whiff such as may arise from the cork of a mercury container starts the indicator.

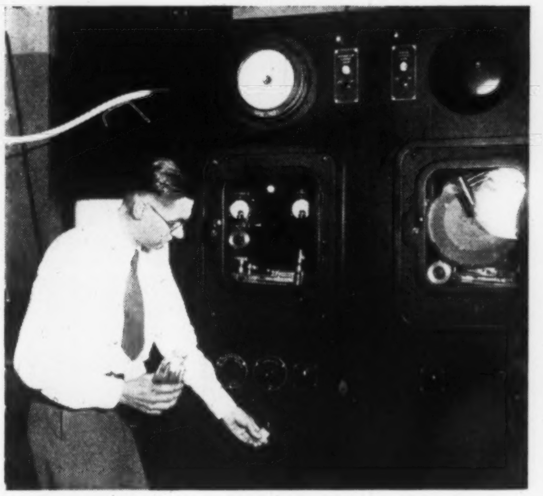


Fig. 1—When the "electric nose" smells mercury vapor a red lamp lights and gong rings

When in operation the new detector "smells" through an internal "nostril" or intake duct which draws in flue gases from the stack of a mercury boiler. The gases pass through an ultraviolet radiation or light beam, coming from a mercury light source and of a wave length known as the resonance radiation of the mercury atom. This radiation is directed from a quartz-sodium phototube, which, unlike the usual type of electric eye, is supersensitive to a beam of this character. Mercury vapor is opaque to this light and casts a shadow, acutating the phototube.

Looking at recent developments in the field of photoelectric equipment reveals an electric eye for stopping the flow of oil to oil-burning boilers in case the fire goes out. Added to this, though somewhat apart from direct machine design application, comes the announcement of the Elgin hardimeter which tests the hardness of water by the photoelectric method. Here a small quantity of chemical is mixed with a sample of water and if the water is zero hard no change occurs in either its color or turbidity. The slightest trace of hardness, however, causes a change in color of the water, the light beam is intercepted accordingly and the amount of hardness is measured.

Progress in Rocket Development

SUCCESSFUL rocket flights recently have swept away much of the skepticism that confronted early development. Even the more conservative designers no longer deny that this type of device holds alluring possibilities (M. D., Aug., p. 28). Most interesting from a technical aspect is the combustion chamber, characteristic of which is that designed by G. Edward Pendray and Bernard Smith Fig. 2. This type has been

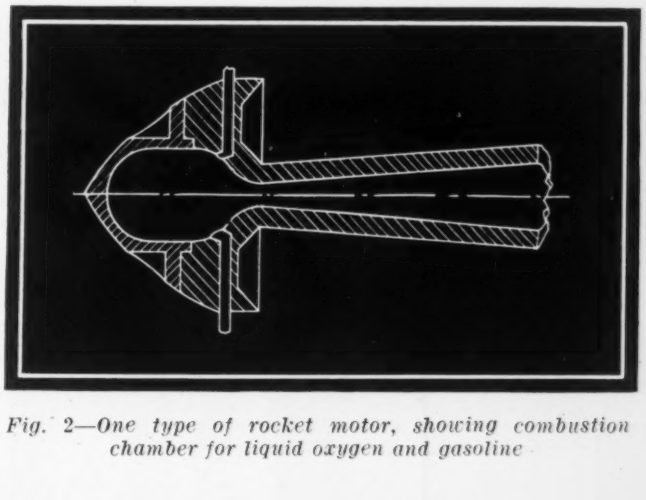


Fig. 2—One type of rocket motor, showing combustion chamber for liquid oxygen and gasoline

used successfully in experimental rockets of the American Interplanetary society in New York.

The combustion chamber is cast in two pieces, being constructed of aluminum alloy. With a pressure of approximately 300 pounds per square inch, this particular unit yields a lift of approximately 60 pounds. Fuels are brought in through small lateral tubes, a liquid oxygen inlet having a cross-sectional area four times that of a gasoline inlet. Tests have shown that the most satisfactory point for introducing the fuels is immediately above the throat as shown in the drawing. The exhaust nozzle extending behind the chamber has a 10 per cent flare and may vary from 6 inches to 2 or 3 feet in length.

Gas pressure forces the fuel into the chamber where they are burned continuously for 20 to 30 seconds. Aluminum alloy fuel tanks approximately 5 feet long and 1½ inches in diameter are attached to the rocket. Driving force is exerted as explosion of the gases in the chamber takes place. Pushing action against the forward or closed end of the rocket motor is not counterbalanced fully by that in the opposite direction due to the presence of the exhaust nozzle, and the rocket therefore is carried in the direction to which the closed end is pointed.

Although fuel now is fed under pressure, it is reasonable to believe that combustion chambers may later be designed that will draw in the fuel with little or no outside assistance.

Roller Chain Serves As Bearing

STANDARD roller chain from stock recently has been used to advantage and economy as a rectilinear roller bearing for the mold holding plate of a plastic press. The strand of chain is interposed between a hardened and ground rail on the bottom of the plate and a similar rail on the bed of the machine as shown in Fig. 3. Side links of the chain provide a guide for the bearing. This idea was employed by Arthur J. Stock, consulting engineer, Cleveland, who found that the standard chain provided a freely moving mechanism and added considerably to the efficiency of the press. Use of end stops prevents the chain from creeping.

In the use of roller chain for this purpose, if extreme precision is required as in the case of the movement of the tables of machine tools, special chain embodying selected rollers of particularly close tolerance may be employed.

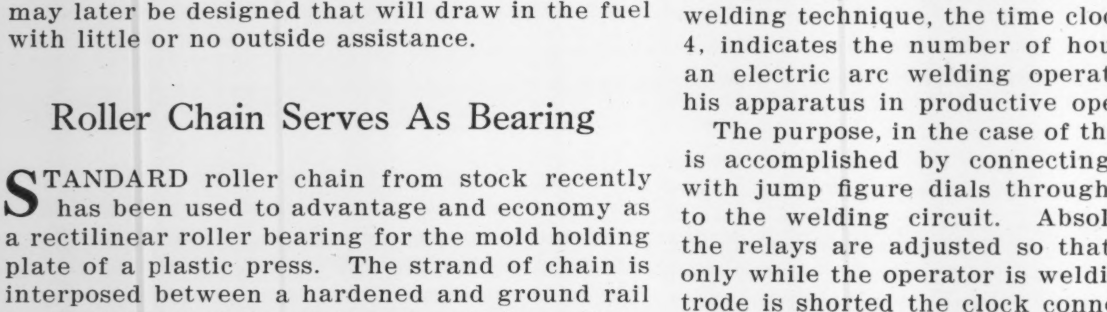


Fig. 3—Side links of a standard roller chain form side guides in its application for this rectilinear roller bearing. Hardened and ground rails are employed

Timing Device Enters New Field

MORE evidence is forthcoming of the trend toward the design and use of timing devices. These are being employed to effect maximum economy in production schedules.

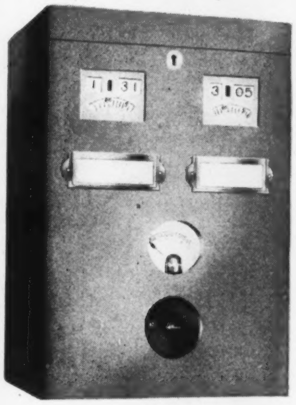


Fig. 4—An electric clock with jump figure dials coupled with suitable relays is embodied in a new welding time recorder. The system is being used effectively in welding to show the number of hours and minutes the welding arc is in productive operation

Designed by Robert E. Kinkead, authority on welding technique, the time clock shown in Fig. 4, indicates the number of hours and minutes an electric arc welding operator actually has his apparatus in productive operation.

The purpose, in the case of the welding timer, is accomplished by connecting electric clocks with jump figure dials through suitable relays to the welding circuit. Absolutely foolproof, the relays are adjusted so that the clocks run only while the operator is welding. If the electrode is shorted the clock connected in the circuit stops; if the arc is held long enough so that no productive welding is accomplished, the clock stops. Restarting is effected automatically when welding is resumed.

The time clock shown in Fig. 4, is suitable for time study on single machines; however, Mr. Kinkead has developed larger units which will handle batteries of welding machines.

As working hours are curtailed, engineers doubtless will be called upon to design and specify more equipment of this kind. Plants will find it imperative to make the most effective use of existing production equipment. Therefore, knowledge of what already has been done in this direction will be an asset to the engineer who is charged with the responsibility of creating ideas for reducing production costs.

Combating the Noise Problem

SILENCING noises is a paramount engineering problem that is being worked out along lines typified by the development of a new muffling device for internal combustion engines, blowers, compressors, etc. The Burgess Battery Co., Madison, Wis., observed in its study of existing equipment that baffle plates and other obstructions in the conventional types of muffling devices build up back pressure and reduce effective output. The result was a manifold of new design, Fig. 5, in which sound absorption is accomplished by means of a porous material faced with a perforated metal lining through which the gases pass. This lining is perforated in a way that allows the sound to penetrate into the porous material freely, but does not appreciably impede the flow of gases. No baffle plates or other deflectors are employed. Little opportunity is afforded by the construction for the accumulation of soot or carbon.

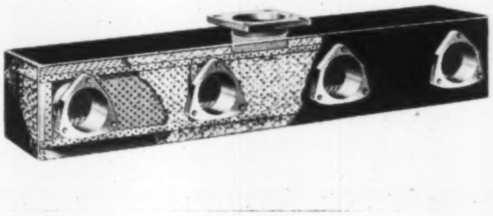


Fig. 5—This muffler is designed with porous sound-absorbing material to quiet noise

Torch Cutting Gains Ground

PORTABILITY has entered the field of gas cutting machines. The new unit, a Linde product, combines the "carry-about" features of a blowpipe with the accuracy and finish of a cutting machine. The blowpipe is mounted on an electrically-driven aircooled chassis equipped with a direct drive to run on either a 1½-inch angle-iron track or any relatively smooth plate. When operated on the track, the machine, Fig. 6, does straight-line cutting automatically. For cutting simple shapes it can be guided with a hand grip. A center and radius rod are furnished for automatic circle cutting. The blowpipe can be adjusted vertically or horizontally, and also to cut bevels up to 45 degrees. A universal motor is employed.

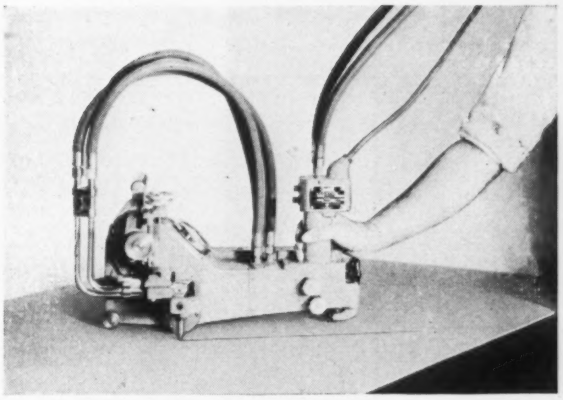


Fig. 6—Portability is an asset to this gas cutting machine equipped with direct drive

The company also is introducing a straight-line cutting machine, the carriage of which is supported by a three-point suspension. An automatic catch disengages the carriage from the worm drive when the end of the track is reached. This unit consists essentially of a steel channel supporting base, means for moving the blowpipe, and adjustments for setting the blowpipe to cut bevels.

Handling Materials Pneumatically

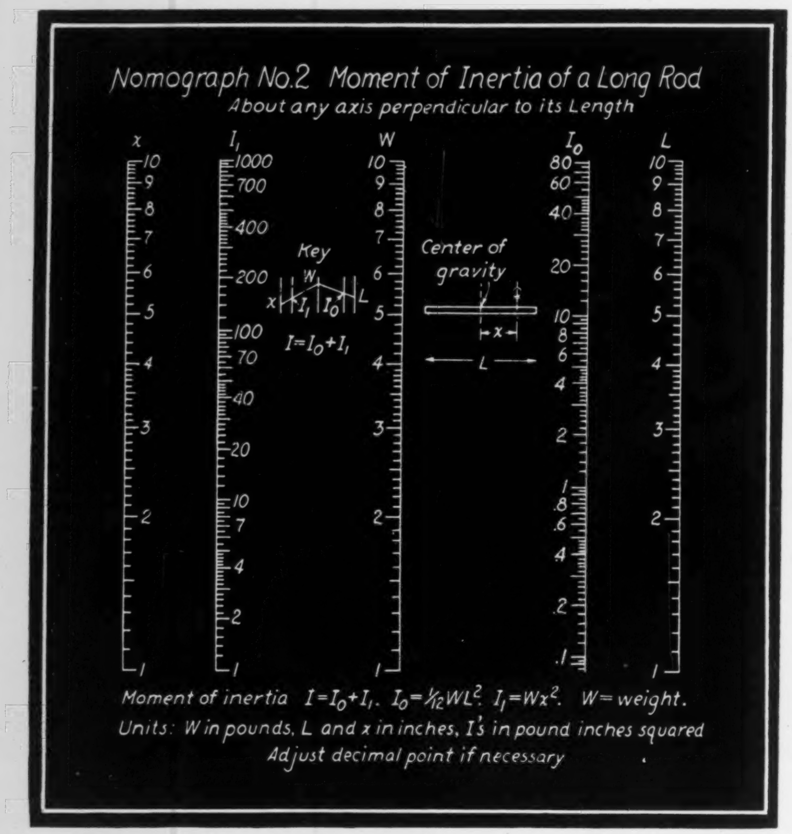
MORE use is being made of compressed air, due to the increasing recognition of its value in the design of machines. Often it permits the elimination of extensive mechanisms as in the case of the pneumatic conveyor developed by Kennedy-Van Saun Mfg. & Engineering Corp., New York. This transport system handles materials such as cement, flour, coal, grains, etc.

An important feature is the automatic closure gate built into the top of the container to seal it during the discharge period. After automatically seating the self-aligning gate, compressed air enters the container and discharges the material. When the transport line is cleared air pressure immediately drops back to normal. The pilot valve which directs the operation of the piston-operated filling gate, main air valve, discharge gate and vent gate in sequence, is controlled by the upward and downward movement of the container as it is being emptied or filled. The system also automatically weighs the material discharged, since a given weight in the container is necessary to set the pilot valve in operation.

For other systems designed to handle materials of this nature, readers are referred to the Redler conveyor described on page 17 in the March, 1933 issue, and to the tank car unloader on page 33, May, 1932.

Simplified Calculations Unshackle the Designer

—Part II—



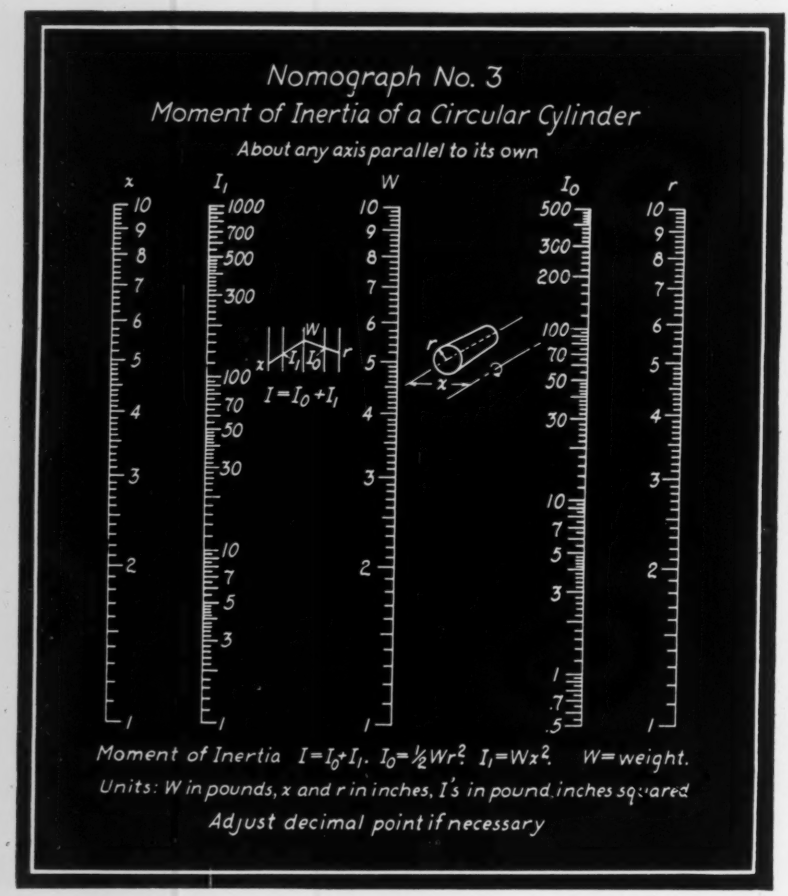
Nomograph No.2 Moment of Inertia of a Long Rod

About any axis perpendicular to its Length

Moment of inertia $I=I_0+I_1$. $I_0=\frac{1}{12}WL^2$. $I_1=Wx^2$. W = weight.

Units: W in pounds, L and x in inches, I's in pound inches squared

Adjust decimal point if necessary



Nomograph No. 3

Moment of Inertia of a Circular Cylinder

About any axis parallel to its own

Moment of Inertia $I=I_0+I_1$. $I_0=\frac{1}{2}Wr^2$. $I_1=Wx^2$. W = weight.

Units: W in pounds, x and r in inches, I's in pound inches squared

Adjust decimal point if necessary

AS SUGGESTED in the first article of this series on page 13 of the October issue, two types of parts will be encountered in the force analysis of dynamic mechanisms—those which rotate about a fixed pivot and those which do not. Because of the difference in treatment, the entire procedure outlined in the previous article will be considered separately for each type of part. The point about which the part rotates will be called *O*, *A* will be the connecting point nearest the driving mechanism (the input point), and *B* the connecting point nearest the tool (the output point). The linear velocity of any point is proportional in magnitude to the distance from that point to *O*, the center of rotation. The direction of this velocity is perpendicular to the line joining the point with *O*.

Similarly, there will be a point *Q* which has no acceleration, just as *O* had no velocity. *Q* is called the center of acceleration, and the

By Joseph Harrington Jr.

acceleration of all points is proportional in magnitude to their distance from Q, but the direction is *not* perpendicular to the line joining the point with Q. Instead, the angle is generally less than 90 degrees, but it is the same for all points.

Treatment Is Simplified

In general, O and Q do not coincide, and it is not easy to determine the location of Q and the angle referred to in the foregoing. But an exception is the case where the member rotates about a fixed pivot when O and Q coincide with the pivot. The treatment is greatly simplified in this case, hence the distinction between the two classes of parts.

It will be most convenient to solve this series of problems graphically. The train should be laid out to scale in the position which it is desired to analyze. A suitable scale is selected to lay out vectors representing velocities and acceleration. An arrow will be used to represent these vectors, attached to the point in question, pointed in the proper direction, and with a length proportional to the magnitude represented.

Outlines Procedure

First find from the space-time, velocity-time and acceleration-time curves of the driving mechanism the velocity and acceleration of the A point on the last part in the train. By graphic methods, get the velocity and acceleration of the B point of that part. Naturally, as the A point of the adjacent piece and the B point of the last piece coincide, the velocity and acceleration of the A point of the adjacent piece are identical to those of the previous B point. Thus we go from piece to piece, proceeding through the train of parts.

Pieces which rotate about a fixed point O now will be considered. Fig. 1 represents a bellcrank lever, pivoted at O. (The arms need not be in the same plane.) As stated in the foregoing, the linear velocity of a point is proportional to its distance r from O, and to the angular velocity ω.

$$V = \omega r, \text{ or } \omega = V/r$$

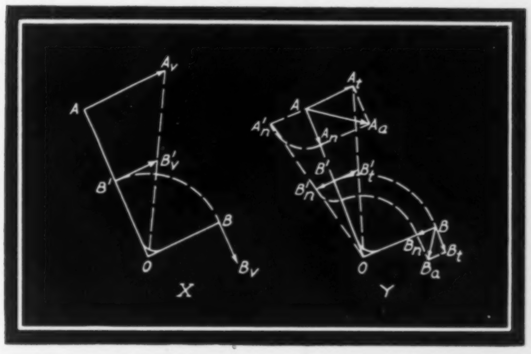


Fig. 1—Bellcrank lever is typical example of parts which rotate about a fixed point

The velocity will be represented by the subscript v appended to the letter representing the point in question, as A_v. Hence

$$B_v = A_v \times BO/AO$$

Fig. 1X gives a graphical solution for this equation. If B were at B' ($B'O = BO$), the tips of the vectors A_v and B_v would lie in a straight line through O. Therefore we may revolve B to B', draw A_vO, and draw $B'B_v'$ perpendicular to AO. B_v' then may be transferred with the dividers or scale to B_v. Linear velocities always can be changed to angular speeds and back again in case pulleys or gears are encountered in the train. N=revolutions per second and V is inches per second, r is inches.

$$N = V/2\pi r, \text{ or } V = \pi r N$$

Any point which moves in a circular path is subject to centrifugal force which makes itself felt as an acceleration toward the center of the path.

Designations Are Given

The total magnitude of this acceleration is v^2/r, and will be represented by subscript n appended to the letter representing the point in question, as A_n. The point also may be subject to accelerations tangential to the circular path. These will be designated by a subscript t appended to the letter representing the point in question, as A_t. Now these two accelerations,

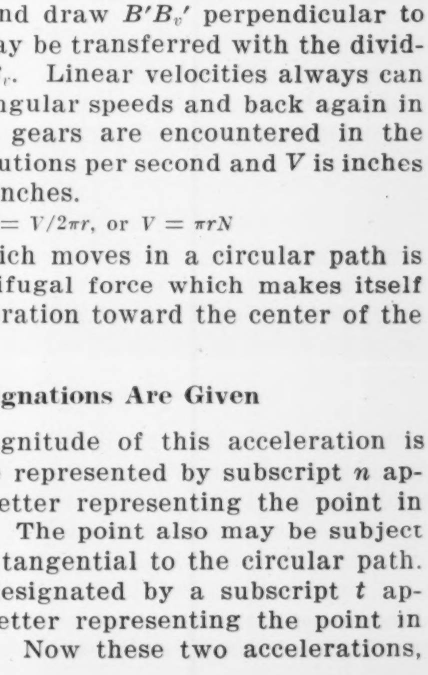


Fig. 2 — Components may be combined graphically by the parallelogram method

normal and tangential to the circular path, are at right angles, and hence are the two components of the entire acceleration of the point in question. They may be combined graphically by the parallelogram method to obtain the total acceleration, which will be designated by the subscript a appended to the letter. See Fig. 2b.

The normal accelerations for A and B can be calculated as the velocities of these points are known. For point A the tangential component of the acceleration also is known from the data on point B of the previous part in the train. This gives the total acceleration of point A.

Pivot Is Fixed

The normal acceleration cannot produce a movement, as the pivot is fixed in the frame. It is evidence of a force which produces no movement of the part. Only the tangential acceleration will act to alter the angular velocity of the piece. It will produce an angular acceleration of α radians per second where $\alpha = a_t/r$. The linear acceleration of a point is proportional to its distance r from O, and for this case (fixed pivot member) and this case only, has a tangential direction. Hence

$$B_a = A_a \times BO/AO, \text{ or } B_t = A_t \times BO/AO$$

Also

$$B_n = A_n \times BO/AO$$

These equations may be solved by a graphical method identical to that used in the case of velocities. See Fig. 1Y.

The reason for finding the two components of the acceleration at B is for transference to the adjacent members. For the determination of force necessary to produce the acceleration in the part itself we will want the angular acceleration α (in radians per second).

$$\alpha = a_t/r$$

where a_t is the tangential acceleration of any point a distance r from the center of rotation. For example

$$\alpha = A_t/OA = B_t/OB$$

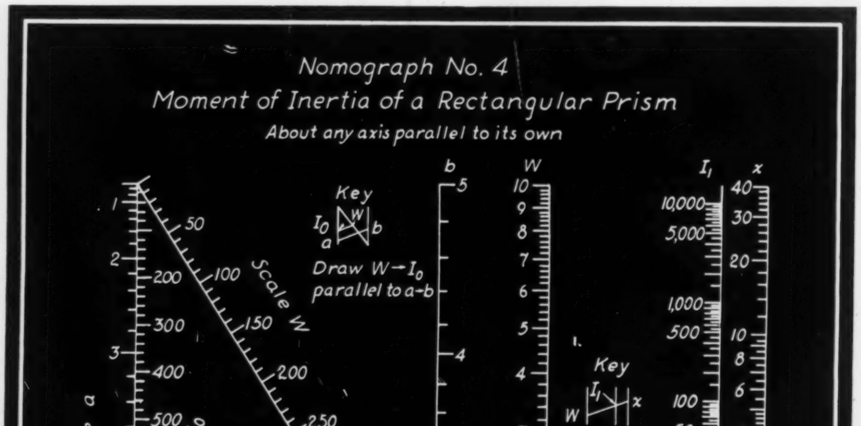
The torque necessary is $T = I\alpha$ where I is the moment of inertia of the piece about O. As a torque is a moment, $T = \Sigma Fr$, where F is the tangential forces producing the torque and r the distances from O at which the forces are applied. A simple method of finding the moment of inertia will be described in the following articles.

An analysis for parts which do not rotate about a fixed pivot will be presented in the December issue of MACHINE DESIGN, while the nomographs will be explained in January.

Measures Minute Time Intervals

VISUAL instantaneous indication of minute time intervals are given by a new high speed timing device which divides one cycle on a 60-cycle wave into sixty, a hundred or even a thousand parts. One method for dividing a cycle into 60 parts uses a synchronous motor-driven disk, rotating behind a shield. Numbers from zero to sixty are cut through the disk at the periphery. As the disk rotates these numbers pass before a viewing slot in the shield. Behind the disk and in line with the slot is placed a neon light which is arranged to flash at the end of the period under operation.

Suppose the time of operation of a relay is to be determined. With the disk being driven at one revolution per second by a 60-cycle synchronous motor, a switch is closed. The circuit is so arranged that the high speed relay is energized at the exact instant the zero on the disk passes by the viewing slot. When the relay functions, the neon lamp is energized. The number illuminated is easily recognizable. This device, developed by Westinghouse engineers, may be used to measure time in a wide variety of operations.


Nomograph No. 4

Moment of Inertia of a Rectangular Prism

About any axis parallel to its own

Moment of Inertia $I = I_0 + I_1$. Left chart: $I_0 = \frac{W}{12}(a^2+b^2)$. Right chart: $I_1 = Wx^2$.

Units: a, b and x in inches, W in pounds, I's in pound inches squared.

Adjust decimal point if necessary

Seals Perfect Lubrication System

By H. F. Shepherd

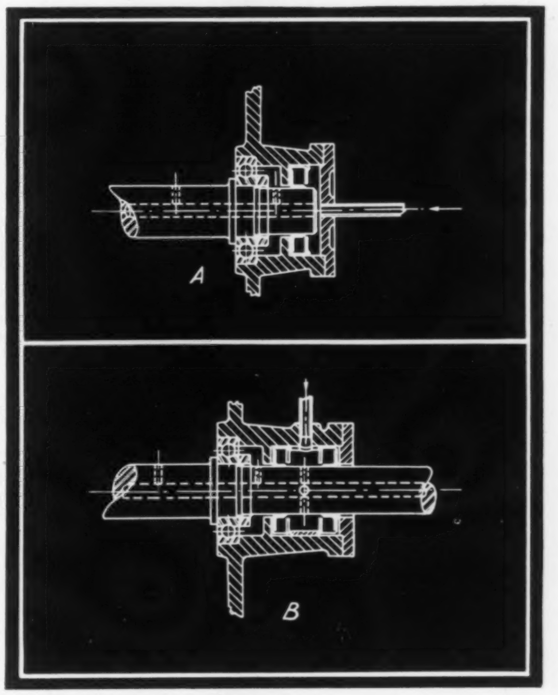


Fig. 1 (A)—Oil admitted through the feed tube is confined by a single seal. (B)—If the shaft must pass through the housing, two seals are used

MANY designers place great confidence in that form of lubricating system by which oil is pumped through a hollow shaft and fed to the various bearings along its length through radially drilled holes. This system has undeniable virtues when the surfaces to be lubricated, on account of their motion, cannot be served as conveniently from any point as from their center of rotation. This is true of crank pins as well as many forms of clutches which idle on the running shaft when disengaged. Hollow shaft lubrication is used even for more ordinary shafting systems to avoid unsightly and easily disarranged small tubing about the outside of the machine.

When several plain bearings are used it is common practice to introduce the oil at any one of them. An annular groove in the receiving bearing is in constant communication with radially drilled holes in the shaft down which the oil passes to the axial hole and thence to the other points requiring lubrication.

Must Choose a New System

As design practice develops an increasing number of antifriction bearing applications, the engineer finds himself confronted with the possible need of abandoning one of his favorite oiling systems since all the oil no longer may be introduced at one of the bearings.

Admittedly even antifriction bearings are the better for a regular oil supply and the hollow shaft may be made to serve them as well as journal bearings. A stuffing box and oil tube on the end of the shaft has been used for this purpose but it has disadvantages. True running requires good lathe work on the shaft end and stuffing box. The admission tube requires good support and alignment and it is always questionable whether proper packings will be used in service.

Unit oil seals embodying specially treated "hat leathers" in a pressed steel case provide a simple and economical solution of this problem. If the shaft is not required to penetrate the housing wall a single leather seal as in Fig. 1*A* confines the oil admitted through the feed tube forcing it to take the path through the shaft bore whence it may be directed as needed.

May Employ Two Seals

If the shaft is required to pass through the housing as for a motor drive, two seals opposed as in Fig. 1*B* are used, the oil being introduced between them. Experience with seals used in this fashion under moderate oil pressure has been quite satisfactory.

Without doubt the maker of the seals should be consulted and given full information regarding their use in this way. Confessedly, they have been used thus far without such sanction. The oil pressure should not greatly exceed five pounds as at higher pressures, of twenty pounds or more, slight heating may occur if the shaft turns rapidly.

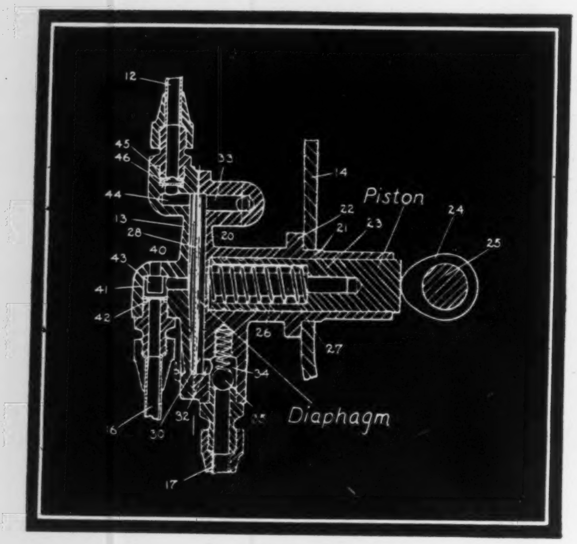


Fig. 1—This gasoline pumping device was not anticipated by the pump shown in Fig. 2, even though its elements are essentially the same

Protect Your Right to a Valid Patent!

By George V. Woodling

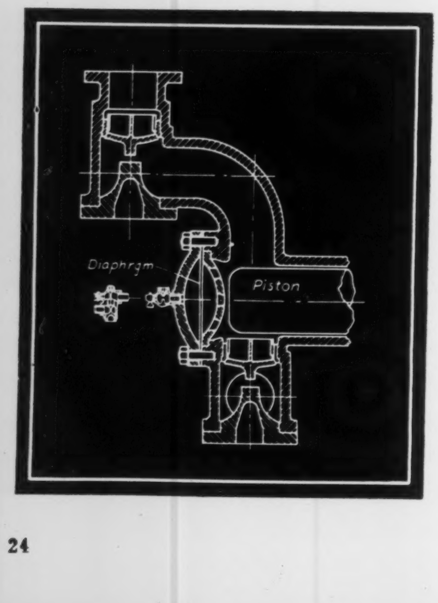


Fig. 2—The cylinder and diaphragm arrangement of this water and air pump was developed over fifty years earlier than the device shown in Fig. 1

LOSS of right to a valid patent through lack of diligence in reducing an invention to practice is a condition with which every inventor or his manufacturing company must reckon. Quite often, failure to make a timely patent application has resulted not from wanton disregard of the patent laws but from the lack of knowledge or understanding of the provisions relating to such conditions.

The filing of a patent application is, in a majority of cases, not only the safest plan but also the most economical way to reduce an invention to practice. This is called *constructive* reduction to practice. The inventor may, however, reduce his invention to practice by embodying it in such form as to render it capable of practical and successful use. This is called *actual* reduction to practice. A model will not suffice ordinarily as an actual reduction to practice. This is one of the reasons that it is preferable to file a patent application and not wait for the completion of the actual reduction to practice.

Undue Haste Dangerous

Although the patent laws contemplate diligence on the part of the inventor in filing an application, undue haste in some cases has proved to be as unfortunate as the lack of diligence. Thus any effort to get a patent as quickly as possible without due regard to a well prepared patent application should be discouraged. This is particularly true in cases involving complicated machines, because a hastily prepared application frequently will be found to disclose an inoperative device. If this is discovered in due time it may be corrected by filing a new application without entailing serious hardship. However, if the defect is not discovered until a subsequent inventor enters the field it may result in the loss of the patent to the first inventor. Furthermore, a hastily prepared application, even if it does not result in the total loss of a patent, usually matures into a weak patent giving little protection. The best plan is to avoid both extremes by filing a strong application with a reasonable degree of promptitude.

In the matter of a delay in filing a timely patent application (see the accompanying patent chart) there are two general provisions of the

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patent laws which, if invoked, may legally defeat the inventor's right to a valid patent. Loss of invention may result from failure to comply with certain statutory bars, or loss may arise from disputed priority where an award of priority is granted to another inventor. These two provisions will be considered separately, but it must be borne in mind that they may operate concurrently.

Let us consider the general case of disputed priority of invention between A and B. The party represented by A may develop a machine that is new and patentable and yet lose the right to obtain a patent for it. In the first place B may have invented exactly the same machine. If both A and B apply for a patent the patent office will declare an "Interference" to determine which one of the two is legally the first inventor and thus is entitled to an award of priority of invention. An "Interference" is in the nature of a judicial proceeding, and accordingly each contesting party is given full opportunity to present his case, including the taking of testimony, and the hearing of evidence given in behalf of his opponent with full right to cross-examine the opposing witnesses.

An interference will never be declared where all the parties are patentees, that is between two or more patents. The remedy for this situation is a suit in equity before the Federal courts. However, the fact that one of the parties has already obtained a patent will not prevent an interference, for although the Commissioner of Patents has no power to cancel a patent he may grant another patent for the same device to a person who is entitled to such an award. In an interference the party first to reduce his invention to practice is called the senior party and is

Patent Law Chart Illustrating Factors Affecting an Inventor's Loss of Right to a Valid Patent

- Factors Affecting Loss of Right to a Valid Patent
  - Anticipation
    - **Unpublished Knowledge**—If an invention was known or used by others in this country prior to the conception date of the invention in question, then the inventor cannot obtain a valid patent
    - **Published Knowledge**—If an invention was shown or described in a patent or in a publication in this or any foreign country prior to the conception date of the invention in question, then the inventor cannot obtain a valid patent
  - Delay in filing a timely patent application
    - Statutory bars
      - **Two Year Publication**—If an invention was shown or described in a patent or in a publication in this or any foreign country more than two years prior to the filing date of the U. S. patent application, then the inventor is barred from obtaining a valid patent
      - **Two Year Public Use**—If an invention was in public use or on sale in this country for more than two years prior to the filing date of the U. S. patent application, then the inventor is barred from obtaining a valid patent
      - **Prior Foreign Application**—If the inventor first filed a foreign patent application and subsequently files a corresponding U. S. patent application more than twelve months after he filed in the foreign country, then the inventor is barred from obtaining a valid U. S. patent unless his U. S. patent issues before the foreign patent
    - Dispute concerning priority
      - The patent office declares an interference to determine priority of invention when—

Example No. 1
A *C* *R*
vs
B *C* *R*
Result: A wins because he was first to conceive and first to reduce to practice

Example No. 2
A *C* (Proves diligence) *R*
vs
B *C* *R*
Result: A wins, notwithstanding he was second to reduce to practice, because he was first to conceive and because he proved diligence

Example No. 3
A *C* (Not diligent) *R*
vs
B *C* *R*
Result: B wins because A was not diligent

Example No. 4
A *C* (not diligent) *R*
(in hospital)
vs
B *C* *R*
Result: A wins, notwithstanding B was first to reduce to practice, because A has a reasonable excuse for not being diligent

Example No. 5
A *C* *R* (Conceals) *F*
vs
B *C* *P*
Result: B wins, notwithstanding A conceived and reduced to actual practice before B conceived, because A was concealing his invention and did not disclose to the public until after a patent was granted to B

Key to symbols: *C* = conception; *F* = filed in U. S. patent office; *P* = patent issued; *R* = actual or constructive reduction to practice; Horizontal length of lines = time.

prima facie the first inventor while the party second to reduce to practice is called the junior party, and hence must carry the burden of proof in establishing priority of invention. However, the senior party as well as the junior party must file a preliminary statement under oath in the patent office showing facts which support his claim for priority. If the invention was made in the United States the statement must include among other things the following important facts:

- Date of original conception of the invention
- Dates upon which the first drawing and the first written description were made
- Dates upon which the invention was first disclosed to others
- Date upon which the invention was reduced to practice

Inasmuch as these requirements must be set forth under oath in the preliminary statement, it is advisable to keep complete records of all circumstances surrounding the invention. Such records are generally referred to as "Disclosures of Inventions" and should include all the necessary data required by the preliminary statement as listed in the foregoing. It is highly important that all sketches, models, drawings and written descriptions be preserved. The first rough sketch made at the moment the idea first occurred is particularly important. The drawings and written description should be dated, signed by the inventor and witnessed by one or more persons who understand the invention.

Interference May Occur

Typical examples illustrating conditions that may arise in interferences are shown in the chart. B, the second inventor to conceive in all examples, wins the award of priority in Examples 3 and 5. This is because, in Example 3, A failed to exercise due diligence, while in Example 5 he concealed his invention from the public. Facts similar to those of Example 5 are found in the case of Mason vs Hepburn, Mason had devised a detachable clip for a shotgun. This device was satisfactorily tested, and the gun with the attached clip in working condition, was concealed in Mason's storeroom for seven years. In the meantime Hepburn made the same invention, Fig. 3, and secured a patent for it. Mason, upon seeing Hepburn's patent, at once asserted his rights to the clip as the first inventor by filing a patent application. An interference was declared and priority of invention was rendered in favor of Hepburn, the second inventor. Mason was too slow in applying for his patent.

The patent laws allow an inventor a reasonable length of time to reduce his invention to practice, but if he fails to do this his rights may be legally defeated by a subsequent inventor. What is a reasonable length of time depends upon the particular facts of each case. For simple inventions it has been held that a delay of four or five months was too long, whereas for large and complex inventions requiring a considerable number of experiments it has been held that six years was not too long, provided that there was uninterrupted activity throughout the extended period.

The purpose of the statutory bars is to compel an inventor to act with promptitude. If the inventor permits the public to use that which he has invented, and stands by for years while they use it, he loses the right to take it back from the public. If he chooses to sell the machine embodying his invention without the protection of a patent, the law presumes that he does not desire such protection.

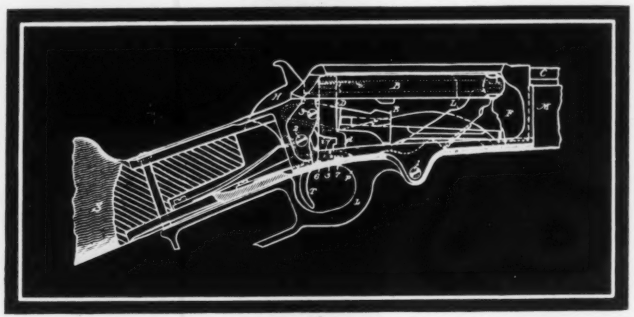


Fig. 3—Although the inventor of the clip for a shot gun was not the first inventor, he was awarded the patent

Under the classification "Statutory Bars" in the chart, there are three general divisions, namely: The bar of two-year publication; the bar of two-year public use; and the bar of prior foreign application.

The bar of two-year publication states that if the invention in question was shown or described in a patent or in a publication in this or any foreign country more than two years prior to the filing date of the U. S. patent application, then the inventor is barred from obtaining a valid patent.

It has been held that a printed publication is anything that is printed and made accessible to the public, such as books, magazines, catalogs or copies of patents, notwithstanding the fact that the patent may be void or might fail to claim the invention. Therefore, if it is desirable from the inventor's or manufacturer's standpoint that a product be described for the purpose of broadening its market, a planned program of procedure in the filing of applications should be formulated and carried out. This is because through inadvertance or mistake the inventor may fail to file an application before the two-year period of publication expires. Another reason is because publication in this country prior to the filing of a U. S. patent application constitutes a bar to the grant of a valid patent in most foreign countries.

To constitute a bar to the right of a valid patent, it is, of course, necessary that the description in the prior publication or patent discloses the complete and operative invention in such clear and full terms as to enable any person skilled in the art to practice the invention with the exercise of inventive skill of his own. That is to say, the invention shown and described in such prior publications or patents must be identical in substance with the invention for which patent protection is sought. Two inventions are identical in substance if they perform substantially the same function in substantially the same way, and produce similar results. However, the two inventions need not be identical in form or structure. A mere colorable variation will not avoid the bar. On the other hand, essential elements not obvious to those skilled in the art cannot be read into a prior description. The test is—what does the prior publication disclose? Not way it might have disclosed, or what it should have disclosed. Thus, it was held that the diaphragm pump recently invented, Fig. 1, which is especially suitable for pumping gasoline with the lubricating oil pump, was not identical to, and thus possessed patentable novelty over, the combination water and air pump, Fig. 2, patented in England in 1877. The decision was based primarily upon the fact that the combination water and air pump was too remote to suggest the combination of the gasoline and oil pump for internal combustion engines.

Bar Is Defined

The statutory bar of two-year public use relates to the effect that the invention must not have been in public use or on sale in this country more than two years prior to the filing of the U. S. patent application. The purpose of the bar is to prevent an effective extension of the seventeen year monopoly afforded by the patent laws, because if the inventor were not compelled to file a patent application within the two-year period there would be a tendency to delay indefinitely the filing of an application until there was threatened competition. Such a delay might amount to several years. The bar of public use is effective regardless of whether or not the use was by a stranger or by the inventor himself.

This bar is strictly applied, and there is no provision found in the statutes nor any decisions of the courts that allows an evasion of it. This is true even though the delay in filing was caused by circumstances beyond the control of the inventor. A single instance of public use is sufficient to sustain the bar. Also, the fact that the invention related to a hidden part of a machine, such as a lock on a safe, and thus could not be seen while in use, does not prevent the bar from being effective. Hence, any use of the complete and operative invention in its natural and intended way is a use in public within the meaning of the statute, provided the use was not merely experimental, or was not kept secret by the inventor. The use is not secret if one or more persons are permitted to witness the invention in operation without a pledge of secrecy. Nor is a use experimental if the tests are not made with a view to perfecting the invention. If the use has passed the experimental stage, thereafter it is a public use.

Issue May Obviate Bar

By international convention the statutory bar of prior foreign application arises if the inventor first files a foreign patent application and subsequently files a corresponding U. S. patent application more than 12 months after he filed in the foreign country. Under such conditions the inventor is barred from obtaining a valid U. S. patent, unless this patent issues before the foreign patent.

This statutory bar is especially important, particularly with companies that own or control subsidiary companies in foreign countries, because if the parent company seeks to obtain corresponding U. S. patents upon the inventions of foreign employes who have already filed in the foreign country, it must file in this country within the twelve-month period after the subsidiary company filed in the foreign country.

A loss of right to a valid patent may result from anticipation of invention. Anticipation prevents the grant of a valid patent not on the ground that the inventor failed to reduce his invention to practice soon enough, but on the ground that he did not invent soon enough.

May Invalidate Patent

Anticipation may be classified as unpublished knowledge, or as published knowledge. Unpublished knowledge includes those cases where the invention was known or used by others in this country but not made a public record prior to the conception date of the subsequent inventor. The patent office will not grant the issue of a patent if it has knowledge of such unpublished anticipation. As a general rule, however, the patent office has no direct means of obtaining such knowledge except through the personal knowledge of the examining corps, and for this reason there are many patents granted which subsequently may be invalidated by a court. However, as between two contesting inventors who have conflicting pending patent applications in the patent office, the Commissioner

(Concluded on Page 59)

Magnesium Alloys Reduce Weight—S

INDICATIVE of the large amount of redesigning that is being done at the present time is the steadily increasing use of light metal alloys. What these new uses are is a question of particular interest to the designer of machinery. Never before have conditions compelled such great attention to machine design. New designs are being developed to improve performance or appearance, or to secure new economies. All of these factors affect the sale and use of the machine.

Lightest of the alloys commercially available for use in new designs are the alloys of magnesium, commonly referred to as dowmetal. The uses of this material seem to follow no particular classification as to size, form or type of machinery. Naturally the lighter alloys are employed for parts that can be improved by reduction in weight. Rotors, reciprocating parts and similar units which have to be moved, transported or carried rapidly from one point to another within a machine or parts of a portable machine are particularly good fields for the material as the lessened weight will reduce starting loads, forces created by the parts, etc.

Weights Are Compared

A better understanding of the extreme lightness of magnesium alloys can be gained by comparison of the weight of this material with other standard materials. The alloys are two-thirds as heavy as aluminum alloys, less than one-quarter as heavy as steel and one-fifth as heavy as brass. Removing one-third to four-fifths of the weight of a machine part is, therefore, their primary purpose.

It naturally is a basic requirement in design that such reduction in weight be achieved without loss of necessary strength and rigidity and without excessive manufacturing costs. These alloys satisfy this requirement as they possess a degree of strength, toughness and fatigue endurance in relation to their weight that compares with high strength steels. They are employed successfully for such severe service as high speed rotors and aircraft motor castings.

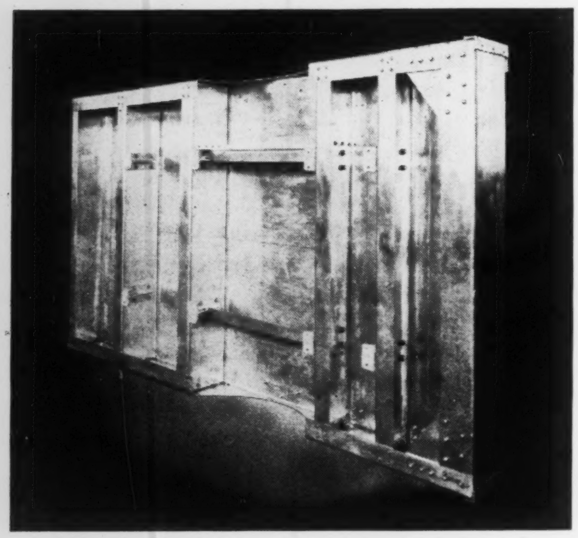


Fig. 1—Considerable weight can be saved by constructing frames of magnesium alloys

TABLE I

Chemical Compositions and Uses of Dowmetal

	Nominal Composition Per Cent			
Alloy	Mg	Al	Mn	Uses
M	98.5	....	1.5	Maximum corrosion resistance. Primarily for fabricated parts not subjected to maximum stresses
F	95.7	4.0	0.3	Forging, rolling, and extrusion where maximum ductility is required
E	93.7	6.0	0.3	Castings requiring good strength without heat treatment. Mechanically worked parts requiring strength and ductility
A	91.8	8.0	0.2	High strength, high ductility, heat-treated castings. Mechanically worked parts requiring maximum strength
G	89.9	10.0	0.1	Heat-treated castings where high yield strength and hardness are of prime importance

Flexibility Is Obtained

Business machines, possessing as they do a large number of rapidly moving rotating or reciprocating parts, have made valuable use of these alloys. A great deal of flexibility has been attained with reduced noise, vibration and wear by application of the material to parts of a folding machine which move rapidly and which are taken off and changed several times a day. The use of the alloys on a prospector's core drilling machine saved 150 pounds.

In considering the use of magnesium alloys

—Strength Ratio

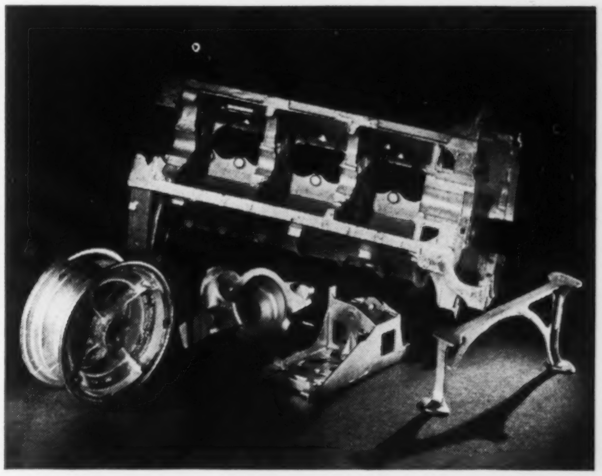


Fig. 2—Die castings will provide parts of intricate shape with thin, light, strong sections

the engineer will wish to study both their properties and fabrication methods.

Dowmetal is fabricated by processes common in industry. It can be cast in sand or permanent molds, die cast, rolled, extruded, and forged. Cast dowmetal has a tensile strength equal to that of cast iron or aluminum, even though much lighter in weight. Rolled, extruded and forged stock possesses a combination of strength and lightness which exceeds that of most other metals.

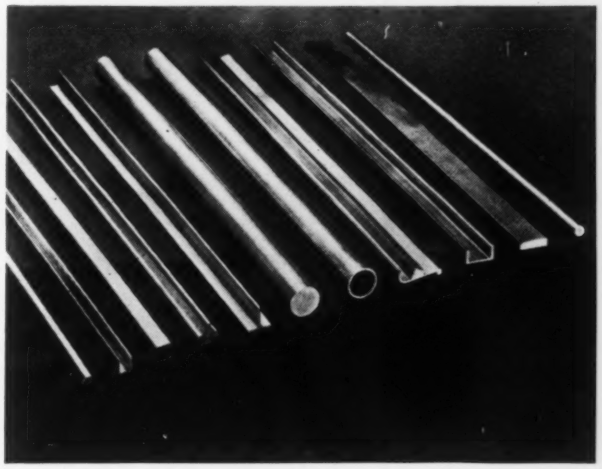
The compositions of the more widely used alloys and a condensed statement of the use for which each is best adapted are given in Table I.

Many Alloys Tested

The selection of the proper alloy depends upon the properties desired in the finished part, whether it be maximum strength, ductility or corrosion resistance. These alloy compositions have been selected from the hundreds experimentally tested, and possess those combinations of properties best adapted for commercial use. The more common physical constants and mechanical properties of the various alloys are given in Tables II and III respectively.

Magnesium alloys work well in the shop and lend themselves readily to machining, joining and other fabricating operations. They will take a roughing cut of ⅛ to 3/16 inch at 200 to 600 feet per minute and a finishing cut of 1/64 to 1/32 at 1000 to 1400 feet per minute. There is no tendency to drag or tear and a fine smooth finish is produced. Ordinary carbon steel tools can be used satisfactorily.

Fig. 3—Light alloy is available in rods, tubes, bars or shapes



These alloys also can be welded readily either by the acetylene, electric spot, or seam processes. The procedure for acetylene welding is not much different than that for any other metal. Filler rod should be of the same approximate composition as the material being welded. Either dowmetal welding flux No. 44 or several commercial aluminum fluxes may be used. The strength of the weld is equal to that of the cast metal. Electric spot and seam welds are made on standard equipment, using pure copper electrodes. The procedure varies from that for other metals only in the amount of pressure and current needed. The alloys require only about one-half the pressure of that for welding

TABLE II

Physical Constants

Property	Alloy M	F	E	A	G
Specific gravity	1.76	1.77	1.79	1.80	1.81
Weight—lb./cu. in.	0.064	0.064	0.065	0.065	0.066
Melting point degree Fahr.	1200	1160	1140	1120	1100
Coefficient of thermal expansion per degree Fahr.	0.000016	0.000016	0.000016	0.000016	0.000016
Thermal conductivity—C.G.S. Units 100-300 degrees Cent.	0.30	0.23	0.20	0.18	0.17
Electrical resistivity in microhms/cm^3 at 20 degrees Cent. of as—cast metal	6.5	9.5	11.0	13.0	15.0

steel of equal thickness, but the current needed is somewhat greater because of higher conductivity. The tensile strengths of single spot welds joining strips of dowmetal F sheet are:

Sheet Thickness, inches	Tensile Strength, pounds
1/32	500-600
1/16	900-1000
1/8	1600-1900
1/4	1900-2200

Riveted joints present no difficulties. Standard aluminum alloy rivets are used because they can be driven cold. The design of riveted joints, the same as with other metals, is based on the shear strength of the rivet and on the tensile strength and bearing strength of the sheet. The bearing strength of dowmetal sheet is approximately 50 per cent greater than its tensile strength.

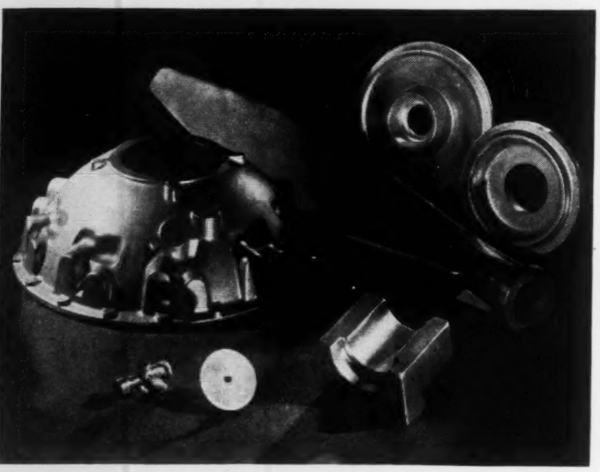


Fig. 4—Improved appearance is secured by use of alloys which are easily finished

Can Bend Sheets Cold

Sheet in the annealed condition can be bent cold. However, sharp bends and deep drawing operations must be done hot and with heated tools. The best temperature range for the hot forming of sheet is 500 to 700 degrees Fahr.

Paint, varnishes and lacquers can be applied to this material the same as to other metals by brushing, spraying or dipping. The synthetic resin enamels give the best protection and are recommended wherever adaptable. Surfaces are best prepared for painting by cleaning to remove grease and dirt and then treating in a "chrome pickle," both containing sodium bichromate and nitric acid. This treatment gives a fine tooth to the metal surfaces, which holds the paint and at the same time affords additional protection.

They Say—

"Industry must be stimulated to make more labor-saving devices to the end that we may have more work. For, paradoxical as it may seem, almost every machine that has a place in our economic life is a labor-saving machine and has given great wealth to the world, which in turn has enabled the people of the world to employ and be employed."—A. W. Robertson, chairman of the board, Westinghouse Electric & Mfg. Co.

□ □ □

"Style has apparently arrived in refrigeration (units). Let it be reiterated: Good performance will keep customers satisfied *after* the purchase; beautiful style will attract customers *before* the sale. It's much easier to sell a difference which can be *seen* than one which has to be *explained*."—from an editorial in *Electric Refrigeration News.*

□ □ □

"It is an absurd proposition to say that man will have to forego the use of all possible methods and devices for increasing efficiency of human labor, when all but a negligible number are far below realizing the standard of living they would like to enjoy. The trouble is not at the door of the machine but other elements in our economic structure."—Hudson B. Hastings, in *The Management Review.*

TABLE III
Mechanical Properties

Alloy	Condition	Tensile Strength lb./sq. in.	Yield Strength lb./sq. in.	Per Cent Elongation 2 inches	Compressive Strength lb./sq. in.	Shear Strength lb./sq. in.	RE Hardness	Brinell Hardness	Impact Tougness	Fatigue Endurance
A	Cast—H.T.	32-36,000	10-13,000	8-12	44-48,000	16-18,000	53-59	47-50	10-14	6- 8,000
G	Cast—H.T.	30-35,000	15-19,000	3-6	48-53,000	19-21,000	69-75	57-63	4-8	8-10,000
E	Extruded	40-45,000	28-35,000	11-17	58-63,000	19-21,000	60-66	51-55	16-19	15-17,000
F	Extruded	38-42,000	27-32,000	14-18	57-61,000	19-21,000	48-59	45-50	12-16	13-16,000
	Forged	34-39,000	20-26,000	7-15	....	....	50-70	46-58	....	11-13,000
	Rolled	32-37,000	15-21,000	5-13	....	....	63-74	52-62	....	....
M	Extruded	39-45,000	25-29,000	4-9	....	17-20,000	30-51	39-46	7-13	5- 8,000

Models Reveal Changes Needed To Combat Fatigue

By R. L. Scorah

FOLLOWING the investigations of Wohler in 1870, the phenomenon of "fatigue of metals" became the subject of many extensive researches. The precision with which the endurance limit of many common structural materials can be evaluated appears as one of the outstanding features of these studies. This important finding provides a unique way of measuring localized stresses by means of fatigue tests.

Briefly this method consists of comparing the endurance limit stress of a specimen whose shape *omits* all "stress-raising" details, to the "apparent" endurance limit stress of a specimen whose shape *contains* the stress-raising detail that it is desired to investigate. In practice such a procedure is carried out by making from the same material two lots of specimens. The specimens of the first lot are made with plain critical sections and are tested one after another by repeated loads of various amounts. In this way there is found the maximum load that can be repeated indefinitely without causing failure. Knowing this endurance limit load, the endurance limit stress at the critical section can be computed by conventional methods.

This stress value is the endurance limit stress for this particular material. The specimens of the second lot are made with some special stress-raising detail, such as a keyway or a sharp shoulder, at the critical section, and are tested in the same way as the first lot.* Because of the presence of the stress-raising detail, the endurance limit load of this second lot will be lower than that obtained with the first and, accordingly, the endurance limit stress computed by conventional methods will also be lower. Now it is argued that since the second-lot specimens fail by fatigue, the endurance limit stress of this material must be reached somewhere within these specimens and, as a consequence, the ratio of the endurance limit stress of the plain specimens to the endurance limit stress of the special-detail specimens is a measure of the stress concentration caused by the special detail. This ratio is called the stress concentration factor.

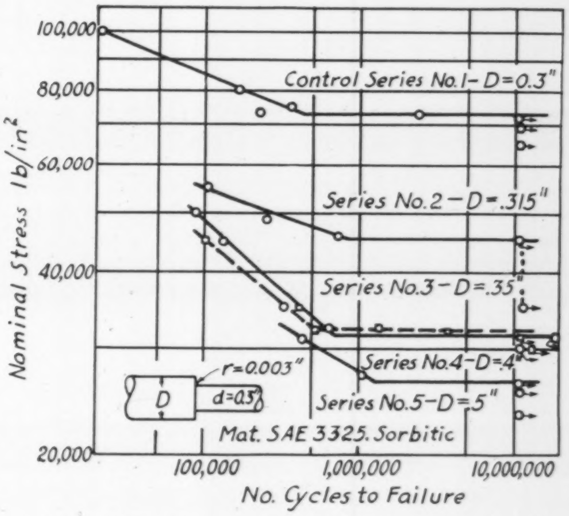


Fig. 1—Fatigue data for shoulder models fixes the endurance limit of the material

TABLE I

Fatigue Results For Shoulder Models*

Series No.	Nominal Dimensions d	D	r	Endurance Limit lb. per sq. in.	Stress Concentration Factor, K
1	.3	......	9.85	73,000	1.00
2	.3	.315	.003	45,500	1.60
3	.3	.35	.003	31,750	2.29
4	.3	.4	.003	31,500	2.32
5	.3	.5	.003	26,500	2.75

*Material, SAE 3325, sorbitic.

It will be observed that the first lot of specimens should be designed for convenience in conducting the tests and computing the value of the endurance limit stress. The specimens in the second lot are really models of the design under investigation. Such models may represent anything from an isolated design detail to a complete structural unit. To illustrate this method and some of its capabilities, certain investigations of shaft details will be described. In this work the author is indebted to Prof. H. F. Moore for his many valuable suggestions and for the use of his laboratory at the University of Illinois.

The well known Farmer fatigue machine provides a convenient apparatus for testing models of shaft details when subjected to pure bending action. This machine is essentially, a rotating beam or shaft which is the specimen under test. The standard type of specimen used has a radius of 9.85 inches to form the critical section at the middle. This curvature eliminates the fillets required with cylindrical sections without disturbing the fatigue results. Knowing the minimum diameter of the specimen and the dimensions of the apparatus, the load required to produce a given stress can be computed by the ordinary flexure formula, $s=Mc/I$.

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*For details of fatigue tests see, among others, Moore and Commers, Bulletin 124, University of Illinois, and "The Fatigue of Metals" by the same authors.

To illustrate clearly the effects of slightly different shapes on the stress concentration factor, a material having a high endurance limit is desirable. For this purpose a chrome-nickel steel, SAE 3325, was selected. This material was supplied in the form of hot rolled ⅞-inch diameter bars and, after cutting to specimen length, was normalized, annealed, hardened and drawn back to 1000 degrees Fahr. The resulting physical properties were as follows: yield point, 100,000 pounds per square inch; ultimate strength, 119,000, elongation, 18.3 per cent; reduction of area, 63.5 per cent; brinell, 332. The microstructure was sorbitic.

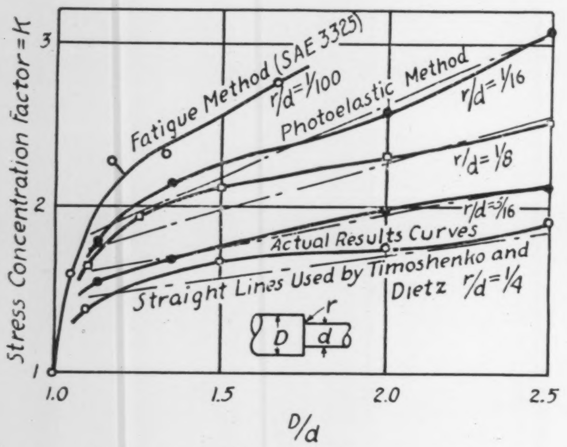

Fig. 2—Stress concentration factors from fatigue and photoelastic methods are in rather good accord

Standard Shapes Employed

The first lot of specimens, the control series, was made in the standard shape. Nominal diameter of the critical section was 0.3 inches. The test results of this control series, plotted in Fig. 1, fix the endurance limit of this material at 73,000 pounds per square inch.

Four different series of sharp shoulder specimens were tested. All of these shoulder specimens had a nominal small diameter of 0.3 inches and a fillet radius of 0.003 inches but each series was made with a different large diameter, namely 0.315, 0.35, 0.4 and 0.5 inches respectively. These small fillets were little less than 90 degrees in the plan view. By placing these specimens in the slide rack of a projection lantern the small fillet radius cut by this tool was measured from the enlarged profile on the screen. The test results of these shoulder specimens are also plotted in Fig. 1. The stress concentration factor, *K*, is found by dividing the endurance limit stress of the material by the apparent endurance limit stress of these respective shoulder specimens. These results are summarized in Table I and plotted in Fig. 2.

The "scatter" caused by the low endurance for series 3 and the resulting higher value of *K* can be largely attributed to the use of a different type of fatigue specimen for this series: a change necessitated by a shortage of material.

It will be interesting to compare these repeated stress results with the photoelastic tests reported in *A. S. M. E. Transactions* for 1925 by Timoshenko and Dietz. Although these two methods are not strictly comparable, they are, as shown in Fig. 2, in rather good accord in this instance. It must be recalled that the photoelastic test model is a flat, two-dimensional affair made of celluloid or some similar material. The method may be likened to a computing machine for the elastic theory and a good agreement between photoelastic and theoretical results is quite usual. The test model used in the fatigue method is, however, a real shaft and not a flat approximation. Further, it is made of a material such as is used in a real service.

TABLE II

Effect of Material on Fatigue Stress Concentration Factors

Series No.	Nominal Dimensions d	D	r	Material SAE No.	Endurance Limit lb. per sq. in.	Stress Concentration Factor, K
1	.3	....	9.85	3325	73,000	1.0
4	.3	.4	.003	3325	31,500	2.32
6	.3	....	9.85	1045	46,500	1.0
7	.3	.4	.003	1045	25,500	1.82
8	.3	....	9.85	1025	39,500	1.0
9	.3	.4	.003	1025	18,250	2.16

Photoelastic tests apply equally to all materials so long as they approximately obey Hooke's Law. This would imply that the photoelastic stress concentration factors cited above apply to all grades of steel. It will be interesting to explore this point by means of the fatigue method.

To test the effect of different materials on the stress concentration factors for shafts with sharp shoulders, two more series of shoulder specimens were made to the dimensions used in series 4 in the foregoing. One series of shoulder specimens and a companion control series was made of a medium carbon steel, SAE 1045. The second group of shoulder specimens and its accompanying control series was made of low carbon steel SAE 1025. These materials were supplied as hot-rolled ⅞-inch diameter bars. After cutting to specimen length they were normalized, annealed, hardened, and drawn back to 1000 degrees Fahr. The resulting microstructures were sorbitic. Physical properties of the medium carbon steel were: yield point, 57,200 pounds per square inch; ultimate strength, 98,900; elongation, 21.9 per cent; reduction of area, 56.8 per cent; brinell, 217. For the low carbon steel the physical properties were: yield point, 49,200; ultimate strength, 75,600; elongation, 27.2; reduction of area, 68.2; brinell 179.

The results for these carbon steels are given in Table II and are plotted in Fig. 4 with curves extrapolated in accordance with the better defined alloy steel curve. Evidently the stress concentration due to sharp shoulders is different for different materials even though their moduli of elasticity are the same. This fact is not disclosed by photoelastic tests. Furthermore, the agreement of the repeated stress and the photoelastic results shown in Fig. 2 would be marred if the repeated stress curve for medium carbon steel were substituted for the alloy steel curve. In such a case the repeated stress results for $r/d=1/100$ would fall *below* the photoelastic results for $r/d=1/8$. This difference in the sensitivity of various materials to the same stress conditions is sometimes referred to as a material's "tenderness."

Aside from these material effects the shape of the stress raising detail has, of course, a great influence on the stress concentration factor.

Shaft Details Important

The results obtained from fatigue tests of five other shaft details are compared in Fig. 3 with one of the sharp shoulder tests described. The same heat treated, chrome-nickel steel was used for these tests. From series 10, it is evident that a groove just behind a sharp shoulder will relieve, to some extent, the intensity of the localized stress. Series 11 shows that even if the large diameter is cut away so as to leave only a thin disk, a sizable stress concentration will still exist. Series 13 represents an oil hole; the stress concentration factor is based on the net section modulus. The keyway test, series 14, indicates that longitudinal irregularities in shape may set up stress concentrations of the same order as those due to sharp shoulders.

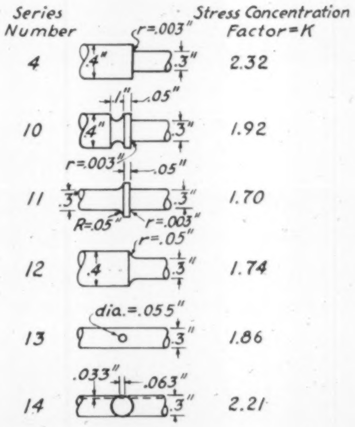

Fig. 3—Results obtained from fatigue tests of shaft details indicate how the part may be redesigned to relieve the stress concentrations

From tests of design details, such as described above, it is only a step forward to make fatigue tests of more elaborate models that represent complete structural units. In many cases the refinements indicated by such tests would prevent troublesome service failures.

This short account of the fatigue testing of design models is intended to draw attention to some of the leading features of this method and to emphasize its ability to provide laboratory tests that closely approximate service conditions. Summarizing the points set forth: The fatigue method has the merit of using test models having three-dimensional similarity with the full scale structure and made of the same structural material. These models, then, represent the performance of *service materials* and thus indicate the effects of "tenderness," quality of finish, and the like. If the structure must withstand repeated stresses in service, which is a common state of affairs, the endurance limit for the model becomes a measure of the stress that would cause a failure in service and as such it provides a valuable basis for estimating the safe working stress. Furthermore, fatigue tests can be conducted at elevated temperatures and in corrosive atmospheres and thus simulate special service conditions. The method assumes added attraction when the element under investigation is cheap enough to be used as the test specimen, that is, as a full scale test model. This would be true for many machine parts and would have the further advantage of eliminating any possible size effect.

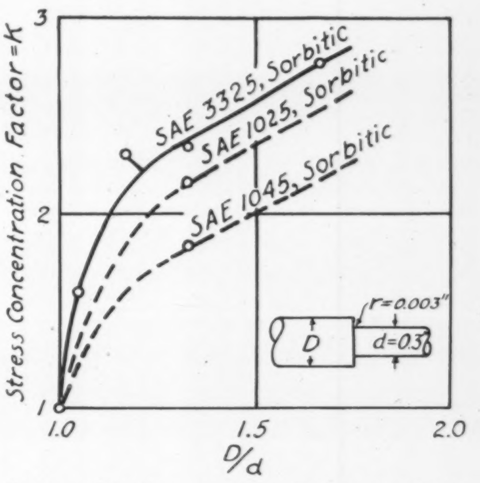

Fig. 4—Selection of material has appreciable effect on fatigue stress

Articles on this and allied subjects presented in previous issues of MACHINE DESIGN include:

"Study of Fatigue of Metals Yields Data for Machine Design," by H. F. Moore, Nov., 1929, p. 35.

"Metal Creep at High Temperatures," by P. G. McVetty, April, 1931, p. 55.

"Relation of Keyways to Fatigue Failures in Shafts," by R. E. Peterson, July 1932, p. 36.

"Service Conditions Control Permissible Stress," by C. R. Soderberg, Feb., 1933, p. 27.

MACHINE
DESIGN

L. E. JERMY, EDITOR
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Capital Goods Industries Will Benefit from Change in Policies

REASSURING to manufacturers of machines, machine parts and accessories is the current trend toward sanity in regard to the important role of the capital or durable goods industries in the national recovery program.

In the early administration of NRA, PWA and other recovery agencies, emphasis was placed primarily upon stimulating purchasing power through re-employment and higher wage rates in the consumer goods industries—i.e., industries whose products are purchased out of earnings. Scarcely any attention was given to the stimulation of purchases of durable goods (products purchased through investment of capital). As a matter of fact, the operation of NRA actually tended to discourage investment in capital goods.

Fortunately Washington recognizes its mistake. General Johnson, who in the early stages of NRA declared it "unwise to emphasize the installation of machinery that tends to further reduce the field of employment," now says, "We must insure the upward trend by making it practicable for purchasing of durable goods to be resumed again." President Roosevelt's eagerness to place steel rail and railroad equipment orders also is evidence of the administration's belated attempt to get behind the "forgotten" capital goods industries.

In pursuing this policy, the government soon will find that the key to the situation is investment of capital. Federal funds will be used as a stop gap, but sooner or later the administration must act to make investment in capital goods attractive to private capital.

Every step in this inevitable program is of the utmost importance to the machinery industries. It is distinctly encouraging to note the charge in attitude.

• • •

Literature Grades the Product

ANY engineer who is fool enough to be "taken in" by incomplete data on a machine part or material deserves all that is coming to him! Yet it has been brought to the attention of MACHINE DESIGN recently that certain little-known materials are being specified by designers largely on the recommendation of aggressive salesmen who are able to offer only verbal information without the support of complete information in printed form.

Fortunately designers in general are analytical to the extent that before specifying requirements they study all pertinent literature published by the manufacturer. It stands to reason therefore that in ninety-nine out of every one hundred the company that is in a position to furnish comprehensive technical literature on its products will be favored with orders. This is the only type of data on commercial parts and materials that is worthy of consideration.

MEN

and Their

MACHINES

L. R. TUFTS AND HIS PAPER FOLDING MACHINE

Men and Their Machines

ENGINEERS generally are made, not born; hardly, so however, with L. R. Tufts. Virtually raised in a machine shop, the son of a practical machinist, he does not remember when he first conceived the function of a lathe or a drill press. He grew up with machinery all about him and early was endowed with its true significance.

Today, as works manager of the Cleveland Folding Machine Co., a unit of the Dexter Folder Co., New York, he is responsible for all design of the former company. By his keen power of observation and close study of new materials, parts and processes he has introduced radical changes in folding equipment. Outstanding have been his accomplishments with torch cut parts in lowering manufacturing costs, reducing weight and enhancing appearance (M.D., Jan.).

When he first entered industry indications were that he would follow automotive engineering. The field was new and the electric auto was at the height of its popularity. He had moved to Cleveland from Chicago, having gone there with his parents from Canton, his birthplace on October 5, 1887. The Broc Electric Vehicle Co. offered him a position; thus he obtained his first technical job at the age of 18.

A few years later, with a diversified experience in engineering, shop, and service departments, he went to St. Louis. There he was draftsman with Moon Motor Co. With the World war came a turning point in his engineering activities. Those machines that had captured his boyhood fancy supplanted his automotive bent. He became a designer of machine tools for the Warner & Swasey Co., remaining until the early part of 1924. At this juncture in his career he was appointed chief engineer of the folding company and rapidly rose to works manager, his present post.

Tufts has no preconceived notions that design ideas are the result of mystic mental communication with unseen forces! On this point he contends that all mechanical creations are induced by those things which the individual has recorded subconsciously at some time in the past, either at technical meetings, exhibitions, visits to plants or through other contacts.

Guessing or bluffing have no place in his makeup. Before arriving at a solution to a problem, Mr. Tufts confesses that he must have a clear, complete picture of what is expected. It saves time to be sure of yourself and your conclusions, he says. He has been accused of being temperamental because he refuses to act on impulse. That accusation is false; the eminently practical side of the man clearly disproves it.

Printing Equipment

PROFESSIONAL VIEWPOINTS

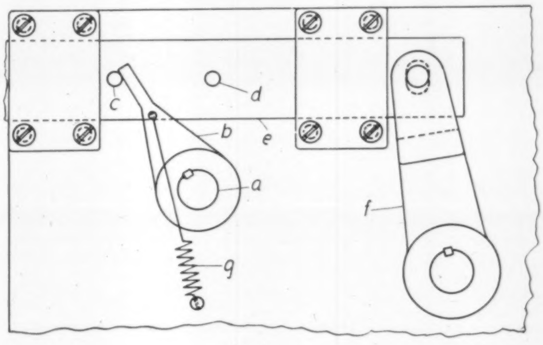
Publication of letters does not necessarily imply that MACHINE DESIGN *supports the views expressed*

Comments and Questions from Our Readers. Machine Design Welcomes Letters or Solutions to Problems Suitable for Publication

Varying Angular Movement

To the Editor:

BELIEVING that other designers might encounter a device in which there is need for doubling and varying angular movement of a reciprocating shaft, I would like to outline one method of doing this. In making certain alterations in a wire mesh weaving machine it was required to transmit a slow and practically constant angular movement from a reciprocating slide to an oscillating shaft during half of the movement of this shaft in one direction. The remainder of the movement in the same direction was to take place at a higher angular velocity. The velocity of the shaft during its return was not important with the exception that the time elapsing between the points of reversal during this movement must be the same as during the first half cycle.



Mechanism provides varying or doubling angular movement of a reciprocating shaft

The mechanism for obtaining this shaft movement is shown in the accompanying illustration. The shaft to which the movement is transmitted is indicated at a. On this shaft is keyed arm b, the upper end of which engages pins c and d in reciprocating slide e. Slide e receives its movement from oscillating lever f, and its movement is slightly greater than the center distance of the two pins.

In the position indicated, the arm and slide are at their extreme left-hand position. As the slide moves toward the right, pin c forces the arm and shaft to rotate in a clockwise direction. When the slide has reached its furthest point at the right, the arm will have just passed its vertical position so that spring g will move it rapidly in the same direction until it is stopped by pin d. Up to this point the arm has moved shaft a slowly through one-half of its movement toward the right, finishing the movement in the same direction at a rapid rate, thus satisfying the requirements.

The slide now returns, causing the movements of the arm to be repeated in reverse order. The variable return movement obtained, however, is not essential to the functioning of the shaft since a constant angular movement would have answered the purpose equally as well. It will be noted also that as compared with the movement of the slide, the movement of arm b is practically doubled by this arrangement.

—J. E. FENNO,
Belleville, N. J.

* * *

Employ a Piece Rate System?

To the Editor:

AN INCENTIVE system in the engineering department may be advisable in order to secure more work in shorter time. However, the need for such a system can be obviated by better supervision and better trained men on the board, requiring less supervision.

Before attempting to establish an incentive system, I believe that a survey of past, present and prospective work should be made to determine the extent to which product and procedure can be standardized; this is the most important step of all. The product should be unitized to the nth degree and a method of investigation and procedure in dealing with drawing office orders laid down which will cut out all lost motion for the working personnel and the supervisor.

Next a simple chart set up should be designed to enable the supervisor to keep daily track of work in progress and work ahead of the department.

Having gone so far, and this is 85 per cent of the way to efficiency, the next thing is to classify the work, somewhat as follows:

Original Design. Few products are so simple that original design work on them can be unitized and the designer's performance checked by an hourly yardstick.

Revised Design. Same remarks apply.

Detailing. This is the first place where it may be possible to apply an incentive system.

Checking. This is too important a function to put remuneration on a per piece basis.

Tracing. This is the only other place where a payment by results system might work to advantage.

After careful analysis of the costs of complete drawings have proved that a worthwhile saving can be made, the next obligation is to set up a yardstick to measure performance, and in this regard nothing is so valuable as an accurate record of past performances. The alternative is to set a time for the job arbitrarily.

This is no easy task and even with the most competent men it will not be easy to operate a system which will produce good work at low total cost. It is my considered opinion that the secret of efficient drawing office operation lays in efficient supervision, which apart from original creative engineering talent is largely a matter of systematic planning, of personnel and work.

—R. E. W. Harrison,
Cincinnati

To the Editor:

THE information that "Chief Engineer" seeks in his letter published in September is available in various forms and the interested party will have to draw his own conclusions. However, I doubt if there is much available information on machine design, though there is a good deal in connection with tool design.

The writer has checked tool drawings designed under an incentive plan, in that case known as a "bonus system." Under that scheme the time allowed for the work was determined *after* the work was done. This method gave the designer a certain amount of leeway to put down on paper ideas as they developed in his mind as the work progressed.

The time was determined by a complicated method of counting certain features of the drawing and measuring others. The results were applied to a previously worked out chart, and from that the required time was calculated. The actual time the design took compared with the time as found on the chart gave the efficiency of the man.

This method worked well for a time, but gradually the designers learned to design drawings with features that counted and measured in their favor. The result was that they were continually designing "Bonus" with little thought for the efficiency and quality of the tools. Some of the errors that went by the checker offset all the efficiencies of the designer, and after struggling with the system for about four or five years the company gave it up.

Another experience the writer had was in a small shop, where the tools to be designed were of a simpler nature and of smaller units. In that case a design time is estimated before the job is started for purposes of establishing a total cost for the tool. In most cases the designer is not even told of the estimate and he usually does his best, and as a rule comes out on top. However, if a job is figured close and the designer finds out about it, he will at once, either through conscientiousness or fear of his job, begin to look for short cuts to accomplish his task in the estimated time. The results are invariably disastrous. They often necessitate additional costs in the shop that far outweigh the saving at the board.

—Estimator,
Cleveland

To the Editor:

THE comments in your September issue by "Chief Engineer" upon the practicability of a piece rate system in a design department bring up a subject of much importance to engineering executives. The writer has always believed the general application of such a system to be an impossibility. There are many conditions, however, which can be handled on a piece work basis with complete success. A description of one such condition may be of interest.

Our shop contracted to build a line of machines from drawings furnished by the customer, but the drawings were dimensioned in the metric system and all notes were in German.

An agreement was reached whereby the customer would pay us a fixed amount to make standard shop drawings. The amount he would allow was slightly less than our close estimate of what it would cost. Therefore, in order not to exceed the amount allowed, a careful analysis of the job was made and it was decided to put the entire job on a piece work basis.

A time allowance varying for 30 minutes to 18 hours was set for each drawing, for checking drawings and for typing material lists. We were criticised for using a unit of time as a basis instead of dollars, but where there are several men to choose from whose hourly rates are different, the writer believes a time basis preferable.

The reaction of the men was more or less neutral. None had done any piece work before. Normally slow men speeded up and either broke even or saved a little time. One fast man saved an average of two hours per day. Every man who worked on the job turned out from 20 to 30 per cent more work than his average.

—William C. Willard,
Buffalo, N. Y.

TOPICS OF THE MONTH

A Digest of Recent Happenings of Direct Interest to the Design Profession

New Committee Works to Correct Evils Arising from Patent Interference

MARKED headway is being made toward the abolition of the present evils of interference in the patent office. This undesirable condition long has constituted a stumbling block to inventors and a drawback to efficient elimination of patent controversy between manufacturing companies. The loopholes in this section of patent procedure often have been used unscrupulously to prevent rightful patentees from obtaining a clear title to inventions.

This is only one of the things that a newly-formed patent committee appointed by the new secretary of commerce, is doing to improve patent procedure. Comprising this group are five practicing patent attorneys from the key industrial areas of the country, two representatives of the patent office and one practitioner from Washington. They are: Loyd H. Sutton, Washington, John W. Townsend, Washington, John A. Dienner, Chicago, Augustus B. Stoughton, Philadelphia, George Ramsey, New York, Justin W. Macklin, Cleveland, James H. Lightfoot of the patent office and Capt. R. S. Patton of the department of commerce. Mr. Sutton is chairman.

Plans are being carried out in line with the goal set by Conway Coe, who was appointed commissioner of patents, the middle of the year. He is making every effort to expedite the granting of patents and to correct the factors which involve patentees in conflicts and long drawn out litigation.

* * *

Gear Manufacturers Forego Technical Papers to Discuss Business

DISCUSSIONS dealing with the NRA and other economic problems occupied the program of the sixteenth semiannual meeting of the American Gear Manufacturers' association, held recently at Wilkinsburg, Pa. Marketing aspects replaced the usual technical activities, the omission of which was a departure from customary procedure. Delegates voted for the adoption of four additional clauses to their NRA code which is awaiting hearing at Washington. Ten new member companies were announced. Speakers included Francis A. Emmons, general sales manager, Foote Bros. Gear & Machine Co., Chicago, who spoke on "Gear Merchandising," and Howard Dingle, president, Cleveland Worm & Gear Co., Cleveland, who discussed "Ethics and Trade Practice."

* * *

Large High Pressure Wind Tunnel Now Being Constructed in England

IN VIEW of the fact that wind tunnel tests have been major factors in redesign, particularly with reference to streamlining, the high pressure tunnel built at the National Physical Laboratory at Teddington, England, is significant. It is 50 feet long, has an internal diameter of 17 feet and is about 2½ inches thick. In this 350-ton steel drum a 60-mile wind can be created in air that is compressed at 350 pounds pressure.

* * *

Use of Labor-Saving Devices Is Objective In New House Planning System

COLUMBIA university has installed a new system of house planning involving the principles which govern the operation of industry. A statement of the plan sets forth that housekeeping has not kept pace with industrial progress. The modern industrial system is characterized by division of labor, obviation of much menial work and by machine methods which lead to the conservation of human energy and an increase of productivity. Only in the home today does one worker with little or no special training attempt to do a number of tasks alone. She works without co-operation, with few tools, little mechanical assistance and usually without training. Immediate objectives of the movement are the elimination of drudgery excessive labor and needless expense. These for the most part will of course be accomplished by the use of labor-saving machinery. Dean Joseph W. Barker of the school of engineering, is vice chairman of the committee working out the arrangements.

* * *

Pocket Radio with New Type of Tube Arouses Engineering Interest

ONE of the radio engineering topics in the foreground is the recent demonstration of a compact transmitter and receiver, small enough to be placed in a coat pocket, sending one-meter waves across the auditorium of the Institute of Radio Engineers in New York. B. J. Thompson, engineer of RCA Radiotron, is the inventor of the tiny "acorn" tubes employed. He declares that this novel tube transmits more power on the one-meter wave than any other device of its type in existence. This has given rise to a new axiom in radio which rules that vacuum tubes must fit the wave length on which they operate. The "acorn" tube, so called because of its shape, is scarcely one-tenth the size of ordinary detectors and amplifiers.

* * *

Non-deteriorating Water-Fast Drawing Inks Developed by Bureau of Standards

WORK of the bureau of standards in preparing water-fast drawing inks which do not deteriorate when stored for at least a year, bears a significant interest from the standpoint of engineering departments. These inks were made of an aqueous 5 per cent shellac solution to which a small amount of phenol, borax and a dye were added. The shellac was unbleached, but was free from natural waxes and dirt. Ninety-two dyes were investigated, 17 found suitable and 7 selected.

* * *

Machine Tool Builders See More Orders As Plant Rehabilitation Begins

ENCOURAGING news comes from machine tool builders. Orders have shown a steady increase during the past weeks and active purchasing is expected to grow in volume in the coming month. One important lathe manufacturer explains that orders are mostly for replacement of existing equipment, indicating that manufacturers in general are beginning to rehabilitate their plants in anticipation of better business through the winter. In addition, new inventions and improvements in the past few years have rendered many old machine tools obsolete.

Automobile manufacturers in Detroit are furnishing a good volume of orders. Machine tool builders state that radical changes in automobile design, including the manufacture of cars without conventional front axles, is responsible for a large amount of new tools being bought.

* * *

Elaborate Fuel and Lubricant Road Test Is Attracting Wide Attention

DESIGNERS will be interested in the fuel and lubricant road test that is under way. A fleet of ten stock automobiles equipped with many types of scientific instruments to test the behavior of gasoline, oil and grease in service, departed recently from Notikewin, a town in the Canadian province of Alberta. The motorcade will cover 7500 miles, with many states in this country included in the itinerary. The expedition is being sponsored by one of the large oil companies and manufacturers of the automobiles used. Forty persons including technical experts and drivers are participating. Data obtained should yield information valuable to those responsible for automotive design.

* * *

Alloy Research Survey Is Indicative of Current Attention to Materials

INDICATIVE of the current interest in materials is the recent announcement that an exhaustive survey is being made of world-wide research on alloys of iron, steel and cast iron. According to reports the survey is about 70 per cent completed. It was organized by the Engineering Foundation in co-operation with leading metal companies. About 4650 technical publications have been reviewed, and books eventually will be published containing all available information on the various groups. The enthusiasm with which this work is being received typifies the interest manifested by designers of machinery in MACHINE DESIGN's *Directory of Iron, Steel, and Nonferrous Alloys*, just published.

Observing Machinery Logically

A Review of "Common Sense about Machines and Unemployment"

WHERE are those high-sounding and equally ineffective theories that were proffered in the early part of the depression? Most of them have been relegated to oblivion along with the sensational accusations that all mankind had been plunged into servitude by a mechanistic Frankenstein that had broken its leash. People no longer are receptive to one-sided tirades on mechanization as the perpetrator of our economic ills.

Common sense judgment is returning. This is exemplified by the engaging discussion contained in a new book, *Common Sense about Machines and Unemployment*. Engineers may not agree wholeheartedly with the author, Morris P. Taylor, but he says much that stimulates thought.

After the reader has grasped the crisp, straight-from-the-shoulder word pictures that are drawn he feels much better fortified to face the facts. The author is a keen observer and relates his findings clearly. Sometimes he says things that may not please the reader, but he is unprejudiced.

Increased Mechanization Is Remedy

His book contains a citation of what faces us, as well as a chapter on possible remedies for an unstable economic situation. He outlines three proposed methods, namely, to allow the present rapid process of mechanization to continue; to maintain the labor-capital ratio of industry constant; to spread out ownership of industry so that a large number of persons of moderate incomes become owners. There are of course, many variables to be considered, but the first plan unquestionably holds the majority of favorable aspects.

The principal change needed is a change in attitude, Taylor believes. We must pay more attention to the continued well-being of all classes in our country and less to the building up of personal fortunes. At the moment, indications are that this is taking place.

Referring more particularly to those aspects of the volume which pertain to the machine's role in our present situation, we find an exceedingly pertinent appraisal of mechanization. Mr. Taylor emphasizes that we must not assume that our present technical development of consumers goods and services will not be improved. The development of new goods and services was one of the factors in keeping trade and industry on a high level from 1922 to 1929. Our present economic depression cannot properly be ascribed to overproduction but rather to underconsumption.

Prosperity and Inventions

His warning that we must not make the mistake of having our industrial well-being dependent on new inventions and developments, may incite some comment, yet he is right in saying that inventions cannot be planned and always will appear at uneven intervals. Some see a tendency toward a controlled machine development policy but it is unlikely that man ever will have much influence on the will of individuals to create new products at scheduled intervals. Moreover, who would attempt to impede progress? Engineers are encouraged continuously, not intermittently, to contribute more and more to technological development.

Unlike some authors who have written on this subject, Mr. Taylor admits that the technological problem is not the only one to be solved. It is plain to him that the depression has had several major causes outside industry. The condition of agriculture, he contends, is only partly due to technological development. Our monetary policy, banking system and financial practices have been defective. We might supplement this statement with our comment that when the depression clouds have cleared, the disastrous influences of these defective financial policies probably will be much more evident than they are at the present time. John C. Winston Co., Philadelphia, is publisher of the book, obtainable through MACHINE DESIGN for $1.50 plus 15 cents postage.

MEN OF MACHINES

Personal Glimpses of Engineers, Designers, and Others Whose Activities Influence Design

INCREASING importance of the selection of metals and alloys has created much in common between the designing engineer and the metallurgist. Activities of the American Society for Steel Treating therefore being of more than passing interest to the designer, attention is directed to the nomination of William H. Phillips as president of the society for this coming year.

Born at Bath, N. Y., July 8, 1887, Mr. Phillips received his preliminary education at Haverling high school. Later he attended Cornell university and was graduated in 1912 with a degree in mechanical engineering. Locating in Pittsburgh, he became affiliated with Jones & Laughlin Steel Corp. in its operating department. To further his understanding of metals he matriculated at Carnegie Institute of Technology where he spent two years on special work in metallurgy.

In 1914 he became identified with the R. D. Nuttall Co. as metallurgist and six years later was appointed manager of works and engineering. Although his present extensive daily duties as vice president of the Molybdenum Corp. of America claim much of his time he has contributed liberally to committee work of the A. S. S. T. and is author of several technical papers pertaining to metallurgy and gearing.

* * *

MULTIMOTORED airplane design owes much to Igor I. Sikorsky. For his attainments in this field the Franklin institute recently awarded him the Howard N. Potts medal. Russian by birth, this noted engineer was born at Kiev in 1889. From Kiev high school he entered the Navy college in Petrograd. After graduating he studied mathematics, chemistry and draftsmanship in Paris, and upon returning to Kiev matriculated at the mechanical college of the Polytechnic institute.

Aviation won his services in 1908, the first machine ever built by him being a helicopter. When he saw that the future of flying lay in multimotored planes he directed his efforts toward their design. In 1913 he built the first successful multimotored ship in the world. During the World war he designed and built 75 four-motored bombers which were used by the Russian army. After the Russian revolution Mr. Sikorsky went to France where he was commissioned to construct this type of plane for military use. In 1919 he came to America and four years later he formed the Sikorsky Aero Engineering Corp.

* * *

CHOSEN to head the Society of Automotive Engineers for 1934 is Delmar G. Roos, chief engineer, Studebaker Corp., South Bend, Ind. Announcement recently was made of his nomination, which under customary procedure is tantamount to election.

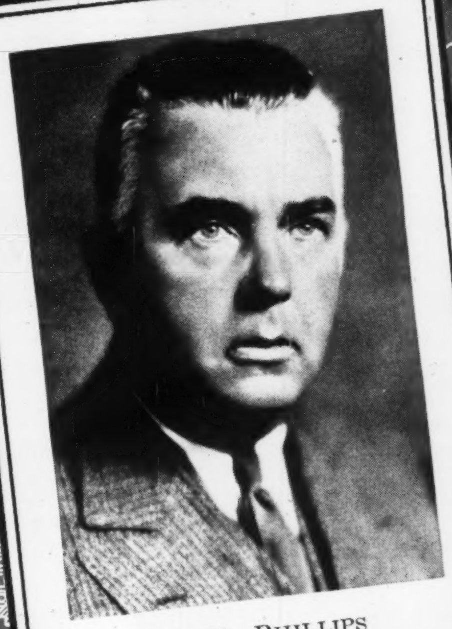
After graduation from Cornell university in 1911, he was employed by General Electric Co. Since 1912 he has been continously in the automotive industry, serving the Locomobile Co. of America in various capacities until 1925 when he resigned his position as vice president to enter the employ of the Marmon Motor Car Co. as chief engineer. A year later he became chief engineer of Studebaker Corp.

Mr. Roos has been prominent in activities of the Society of Automotive Engineers, including vice presidency of passenger car division, membership on the military motor transport advisory committee and ordnance advisory group. He also has taken an active part in the work of the research committee and several committees of the standards division.

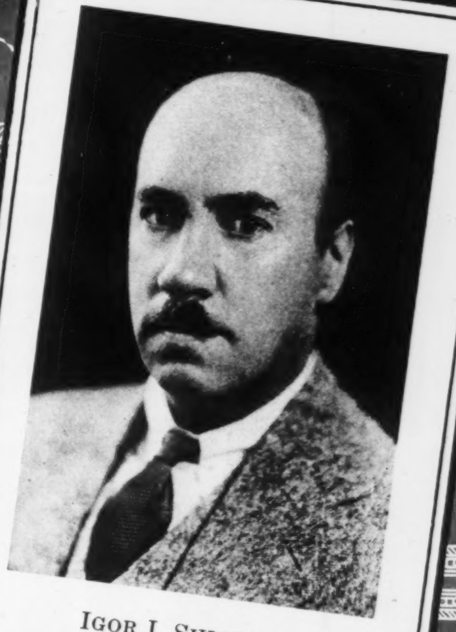
* * *

ENGINEER, manufacturer of steel products, and executive of national and international experience. Such is the record of John W. O'Leary who has been chosen to head the newly-formed Machinery and Allied Products institute. In his new capacity he directs the organization which constitutes a federation of trade associa-

Leaders in Design, Engineering and Research



W. H. PHILLIPS



IGOR I. SIKORSKY

DELMAR G. ROOS

J. W. O'LEARY

tions representing hundreds of interests included in the machinery and related industries, with particular reference to their activities under the industrial recovery program.

Born in Chicago in 1875, he still maintains that city as his headquarters. After attending the local public schools he entered Armour Institute of Technology. Graduating from Cornell university in 1899 with a degree in mechanical engineering, he joined his father in what now is the Arthur J. O'Leary & Son Co., Chicago. After his father's death in 1923 he became vice president and treasurer of the company, continuing in those capacities up to the present time.

Evidence of Mr. O'Leary's wide industrial interests is found in the directorships he holds in various companies including the Chicago Great Western railroad, Advance-Rumely Co., LaPorte, Ind., Belden Mfg. Co., Chicago, Chicago Railways Co., and others.

* * *

Walter Sheldon Tower, who was elected secretary of the American Iron and Steel institute at a meeting of the board of directors in New York, recently, has been manager of commercial research for the Bethlehem Steel Co. In his new position Mr. Tower will organize the institute staff and will have charge of administering the institute's affairs.

* * *

Lloyd Jones, who has been manager of the Salem, O., works of the E. W. Bliss Co., has resigned. His successor, L. W. Nash, has for a number of years been with the organization as chief designing engineer in the rolling mill department of the Salem works.

* * *

Norman L. Daney has been elected general manager, Harris-Seybold-Potter Co., Cleveland. For eight years Mr. Daney was associated with the engineering department of the United States Steel Corp.

* * *

Newly nominated vice presidents of the various activities of the Society of Automotive Engineers include: Aircraft, T. P. Wright, Curtiss Aeroplane & Motor Co.; Aircraft Engines, Robert Insley, research engineer, United Aircraft & Transport Corp.; Diesel Engines, H. D. Hill, Hill Diesel Engine Co.; Fuels and Lubricants, A. L. Clayden, research engineer, Sun Oil Co.; Motor Trucks and Motorcoaches, A. K. Drumbaugh, White Motor Co.; Passenger Cars, F. F. Kishline, assistant chief engineer, Graham-Paige Motors Corp.; Passenger Car Bodies, John W. Votypka, chief engineer, Le Baron-Detroit Co.; Production, W. H. McCoy, General Motors Corp.; Transportation and Maintenance, L. V. Newton, Byllesby Engineering & Management Corp. Councilors include J. M. Crawford, chief engineer, Chevrolet Motor Co.; J. B. Fisher, chief engineer, Waukesha Motor Co.; and J. F. Winchester, Standard Oil Co. of New Jersey.

* * *

William S. Knudsen, vice president of General Motors Corp. in charge of the Chevrolet motor division, has been appointed executive vice president of General Motors, effective October 16. He will be the chief executive officer of the corporation at Detroit, assuming general supervision over all car and body manufacturing operations in the United States and Canada.

* * *

L. A. Pease, for 25 years associated with the engineering staff, Fairbanks, Morse & Co., Beloit, Wis., has become associated with A. O. Smith Corp., Milwaukee.

* * *

R. L. Foote has been appointed head of the engineering service department of the Synthane Corp., Oaks, Pa.

* * *

A. W. Schneider, formerly with Reed-Prentice Corp., Worcester, Mass., has become associated with the Heald Machine Co., Worcester, in an engineering and sales capacity.

* * *

Louis Steinfurth, East Cleveland, O., formerly chief engineer and assistant manager, Economy Machinery Co., Willoughby, O., no longer is associated with that organization.

* * *

Rev. Julius Arthur Nieuwland, professor of organic chemistry, Notre Dame university, South Bend, Ind., has been awarded the Morehead medal by the International Acetylene association.

* * *

J. H. Johnston has been made manufacturing engineer, foundry and Micarta division, at the Cleveland works of Westinghouse Electric & Mfg. Co.

* * *

E. C. Crittenden, formerly chief of the division of the bureau of standards, has been appointed assistant director of that bureau in charge of research and testing, to fill the va-

(Concluded on Page 63)

NOTEWORTHY PATENTS

A Monthly Digest of Recently Patented Machines, Parts and Materials Pertaining to Design

EXTREME flexibility and tendency of the new large low pressure tires to flatten out introduced a problem in automobile steering mechanism design. With conventional equipment, steering has been made more difficult; William B. Stout observed this and patented a controlling mechanism which combines the various auxiliary devices employed in the operation of a car into a unitary system, Fig. 1. A power-operated "joystick" is employed.

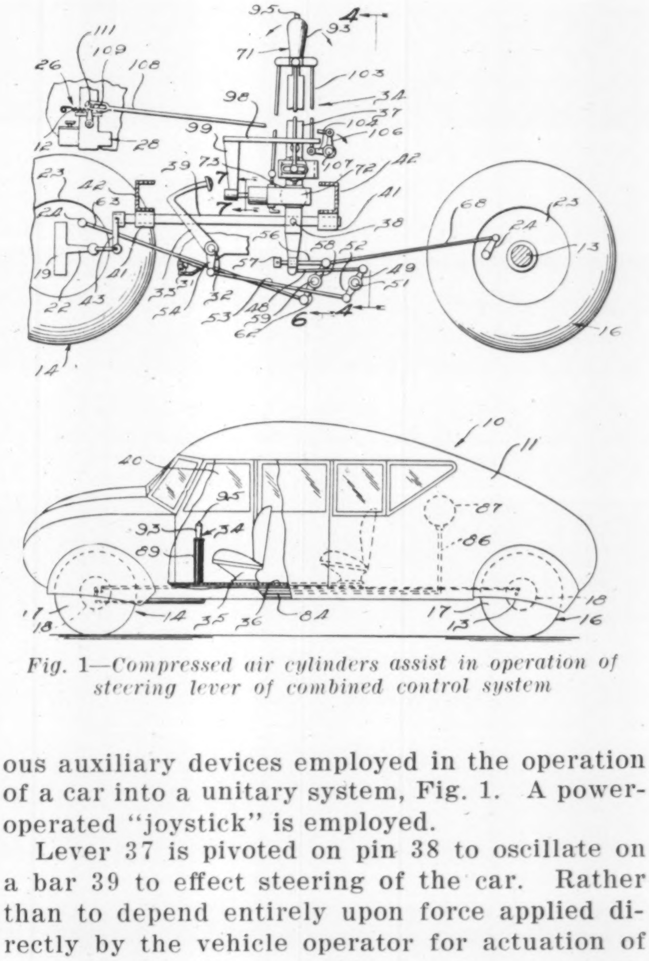


Fig. 1—Compressed air cylinders assist in operation of steering lever of combined control system

Lever 37 is pivoted on pin 38 to oscillate on a bar 39 to effect steering of the car. Rather than to depend entirely upon force applied directly by the vehicle operator for actuation of lever 37; Mr. Stout provides a pressure actuating device 71. This mechanism comprises an air cylinder 72 universally mounted as indicated at 73 on level 37, as well as a pair of cylinders (not shown), mounted laterally and likewise universally. The operation of these cylinders is effected automatically by the admission of compressed air as the handle 93 is moved, providing an auxiliary force to steer the car.

Briefly the procedure is as follows: When the engine has been started and it is desired to run the vehicle forward, clutch pedal 33 is depressed and the gear shifting mechanism operated in the normal manner. Simultaneously with the release of the clutch, controlling handle 71 is pushed forward to a slight extent to accelerate the speed of the engine.

When it is necessary to steer the car to the right, for example, operating handle 93 simply is moved in that direction. This elevates the proper air cylinder above a port, thereby admitting compressed air from tank 87. A piston rod connected to arms such as indicated at 99 in Fig. 1, forces the lever in the desired direction. Cylinder 72 shown in the top drawing governs the lever during braking. Forward movement of the lower end of lever 37 first will disengage clutch 31 by operation of rods 48 and 53, and thereafter the engagement of the lever with stop 57 will apply the brakes of the vehicle.

Number 1,928,915 has been assigned to the patent.

TO KEEP pace with progress in air conditioning requires investigation from many angles, so extensive has become its field. One method is a study of patents issued; among the recent devices emanating from this channel is a

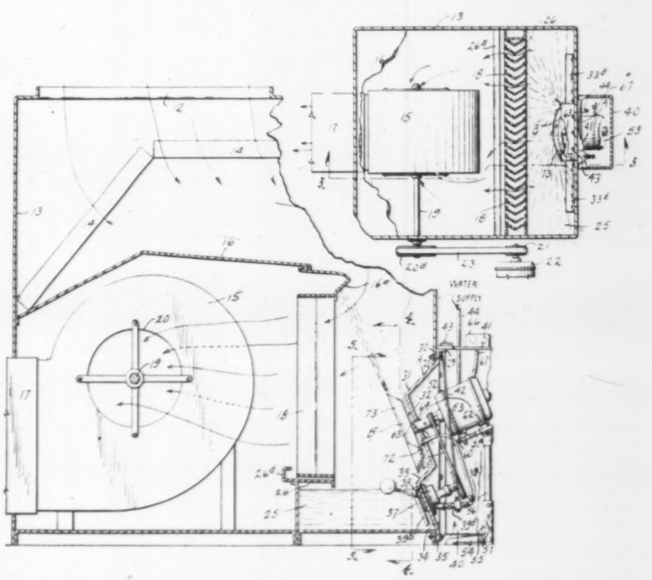


Fig. 2—Air conditioning unit employs motor-driven spray mechanism which is controlled automatically

unit designed by John W. Norris for use with heating plants. Lennox Furnace Co., Marshalltown, Ia., is assignee. The most interesting part of the arrangement is the rotary sprayer that throws a screen of water through which the air passes. Thus the air is washed and humidified.

The spray producer, Fig. 2, has a flat disk 72 with an annular peripheral flange 73. Water is fed up to the back of disk 72 and flows to its outer edge, thence over the inclined flange, from which it is thrown straight out. There is thus created a fine mist in a sheet directly across the travel of the incoming air before it reaches the eliminator plates.

Air with any water that it may carry travels between the eliminator or scrubber plates 18 in angular paths. In its impact with these obstructions any surplus of moisture is deposited.

As shown, a water reservoir 25 is located at the bottom of casing 13. The eliminator plates are arranged above the forward portion of the reservoir. Drain plates 26 are provided to conduct the water dripping from the plates back to the reservoir. Supported on the rear of portion 34 of panel *A* is pump 38. Pipe 39 leads from the discharge end of the pump upwardly, conveying the water to the back of rotary spraying element *B*.

When water stands at the desired level in the reservoir a float closes a valve and prevents the inflow of more water. Opening is effected when the water supply is lowered. Two motors, 22 and 53, are connected in parallel so that when the blower starts the spray mechanism is started also, subject to the operation of the thermostat which may automatically cut out the spraying device if the room shows sufficient humidity.

The patent has been designated No. 1,925,907.

FINGER grip mechanisms have an important place in design; therefore the device developed and recently patented by R. L. Wilcox for the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. is worthy of attention. Means are provided for applying additional pressure through fingers to an article gripped at a predetermined period in the cycle of operation. Details of the device applied to an upsetting machine are shown in Fig. 3. Projection 30 is an integral part of knockout rod 14, as is also the projection 32 on punch 33. Transfer fingers 23 and 24 are utilized as a stripping device. This is accomplished by applying sufficient pressure on the blank 31 by fingers 24 to hold it rigid and permit withdrawal of 30 and 32.

Journalled in the die block 15 is a rock-shaft 34, having an arm 35 under the die block and arm 36 above the die block. Threaded in each arm is a set screw 37, the inner end of which engages tail 38 on the finger 24. Rotary motion is imparted to the rockshaft 34 through rockarm 39. Outer end of arm 35 projects into a groove in the spool 40 on reciprocating shaft 41 journalled in a bracket 42 fixed to frame 10. Shaft 41 is moved lengthwise against tension of a spring, thus rocking rockarm 39 and with it shaft 34. Timing of these parts is such that a gate recedes and allows the knockout mechanism to eject the blanks from the several dies and cut off a new blank from the rod length. As the knockout mechanism is actuated, additional pressure is applied to fingers 24. Extent of pressure and timing of application are determined in part by adjustment of screws 37.

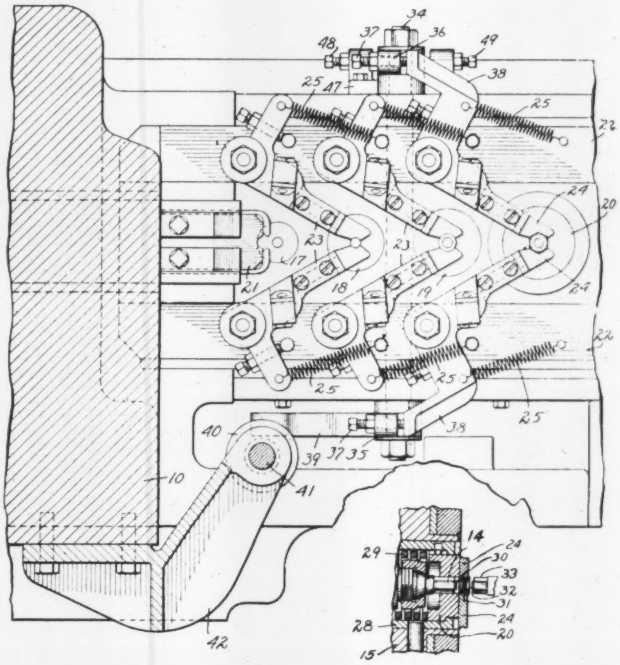


Fig. 3—Finger grip mechanism for applying additional pressure at stated operating intervals

The patent is designated 1,929,862.

Review of Noteworthy Patents

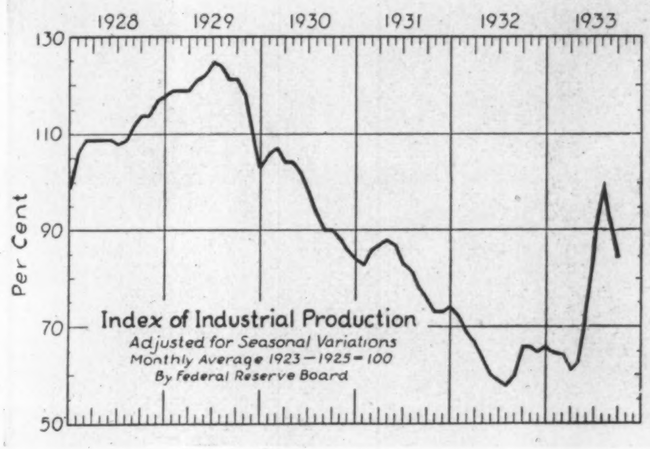
Other patents pertaining to design are described briefly as follows:

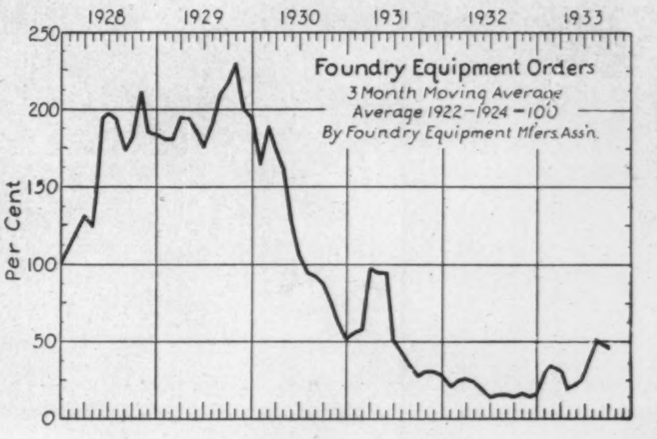
MACHINE FOR APPLYING CEMENT. 1,932,542. This unit embodies a driven applying roll, a cement receptacle beneath the roll and a work table. Assigned to United Shoe Machinery Corp., Patterson, N. J.

MINING APPARATUS. 1,932,596. The machine covered by this patent has a kerf cutter adjustable into horizontal and vertical cutting positions. Assigned to Sullivan Machinery Co., Chicago.

CASH REGISTER. 1,932,621. Covered in this patent is a consecutive number counter and means for actuating the counter. Assigned to National Cash Register Co., Dayton, O.

TYPEWRITING MACHINE. 1,932,620. Carriage escapement mechanism is one of the features of this invention. Assigned to Remington Rand Inc., New York.



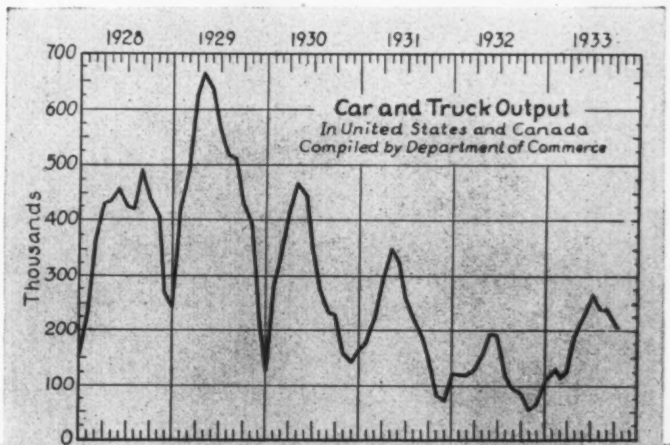


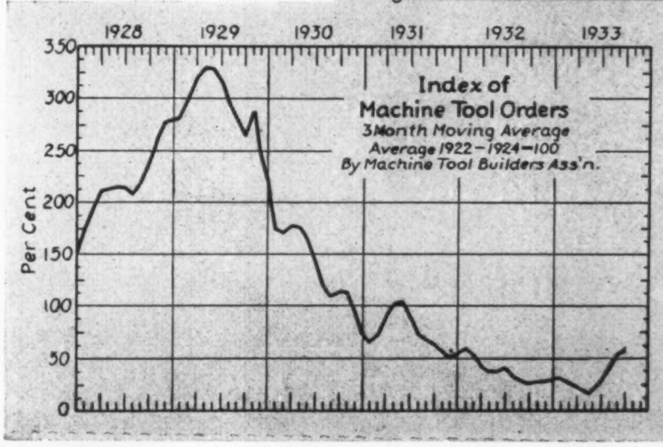
How Is Business?

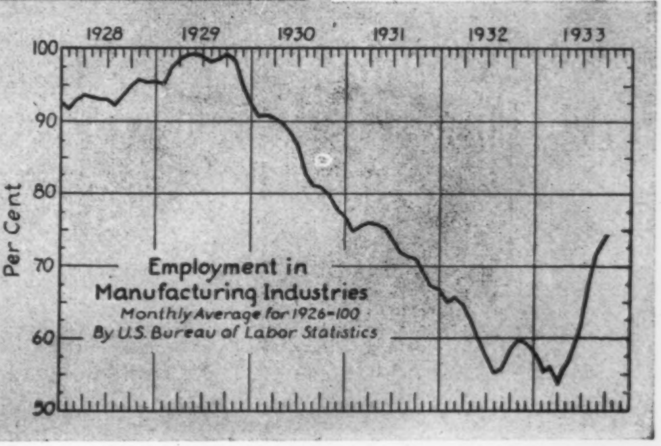
UNCERTAINTY caused by disputes over codes, strikes and rumors of strikes, and the fears of sound money advocates slowed up the improvement considerably during the late summer and early fall days. Now, however, decisive action of the administration has done much to give business renewed hope.

Despite this uncertainty many lines of industry have held to the gains made earlier in the summer. One such case is that of the machine tool industry which has maintained for three months an average of about 50 per cent of the activity of 1922-24. Admittedly a small amount, but still three times greater than the activity last spring. The National Machine Tool Builders association says, "What is needed now is a better distribution of the machine tool orders that are being placed. Some of the heavier types of machines scarcely participated in the improvement, and there are still too many builders who's business is below 20 per cent on the index."

That a better balance between cost of living and earnings is being achieved is shown by the index for earnings in the metal trades. During September this index gained again on the cost of living, and while earnings are still below costs, they have reached a point closer to the costs than at any time since June, 1931.





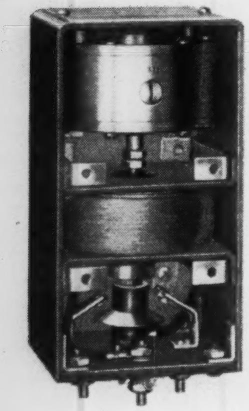


NEW MATERIALS AND PARTS

Worthy of Note by Those Engaged in the Design of Mechanisms or Machines

Relay Gives Accurate Time Control

DESIGNED for use in conjunction with any electrical device requiring a delay interval, the Agastat, introduced by American Gas Accumulator Co., Elizabeth, N. J., is an instantaneously recycling unit which will give a delay ranging from a fraction of a second to several minutes. The time unit on this electrical time delay relay, shown herewith, being hermetically sealed and compensated, is unaffected by dust, temperature or humidity changes. The timing period is not affected by fluctuations of voltages. Few moving parts are used. Positive snap make-and-break action is provided on silver contacts. The relay, which lends itself to a wide variety of applications, has been developed in co-operation with Ward Leonard Electric Co.



Time delay ranging from a fraction of a second to several minutes is provided by new relay

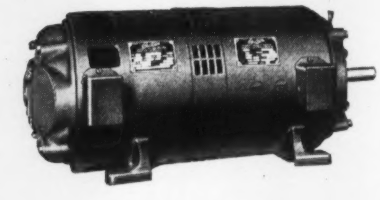
New Stainless Steels Announced

STAINLESS steels in two grades, Armco 17 and Armco 18-8, in sheets, strips and plates are being offered by American Rolling Mill Co., Middletown, O. The 17 grade is intended for use for automobile parts, furnace parts, nitric acid and oil refining equipment, and oil burner parts. The 18-8 is planned for airplane parts, baking, laundry and dairy machinery, hotel, restaurant and kitchen equipment, soda fountains and counters, and similar uses. Performance of the material under the dies has demonstrated good ductility and formability.

Dual Motors Are Introduced

DUAL motors which operate on direct current from generators on the moving equipment when the equipment is running, and from central station power when the equipment is standing have been developed by Century Electric Co., St. Louis. The motors, available in ½, ¾, 1 and 1½ horsepower sizes, will operate portable machines from direct or alternating central station power when the equipment is moved from one location to another, or from one part of the same plant to another, when the same kind of current is not available.

The dual motor consists of two separate motors in one two-bearing frame with the two rotors on one shaft. This makes a compact unit that is convenient to install, occupies small space and requires only one shaft connection to the driven apparatus.

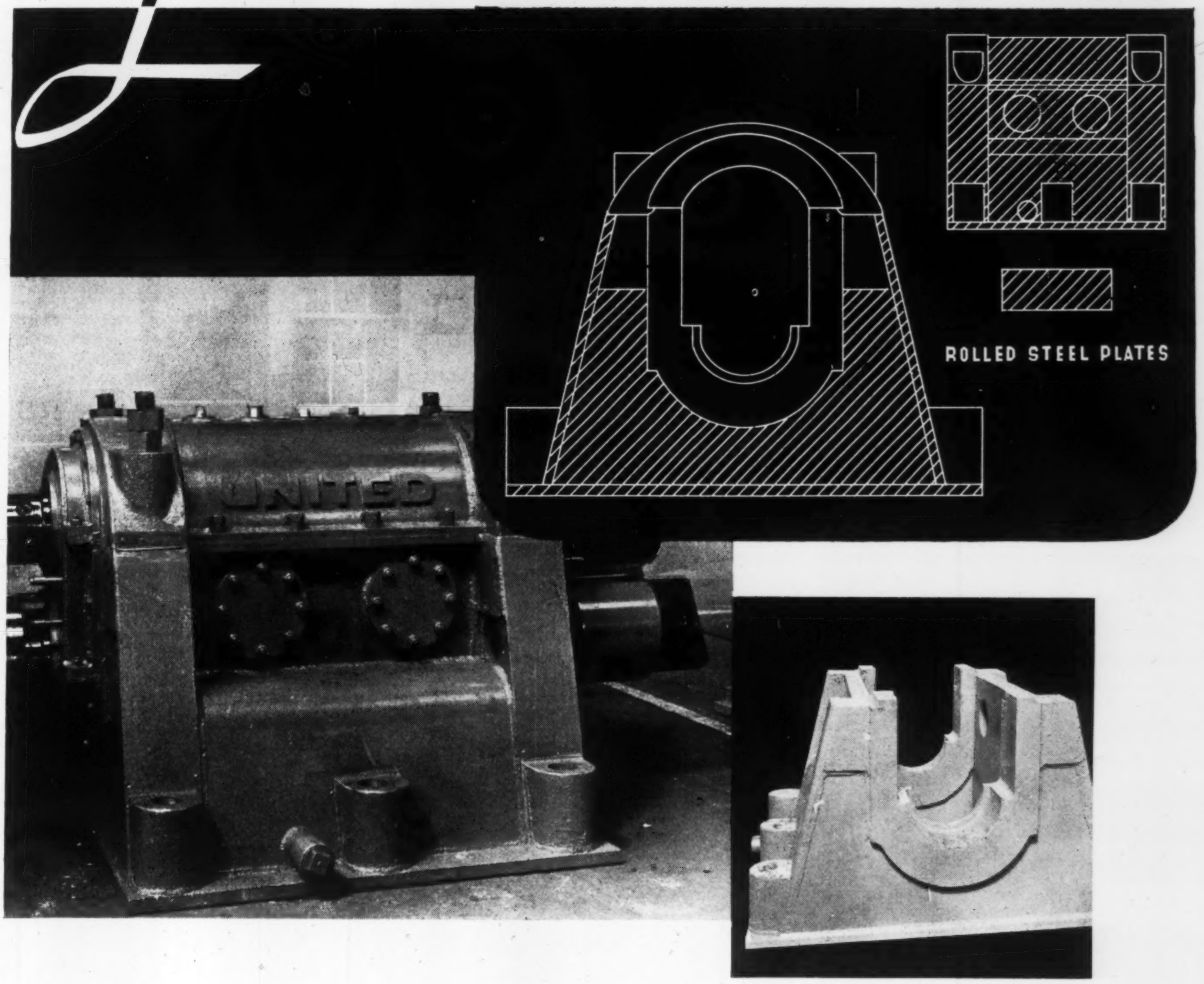


Two motors are included in a single case in dual power unit

Push Button Stations Are Improved

RUGGED start-stop push button stations of improved design now are being offered as standard equipment by Industrial Controller division, Square D Co., 710 South Third street, Milwaukee. The push buttons, shown herewith, are extra large—1-inch diameter. Buttons and stems are molded of bakelite in one piece and are supported by compression springs with an

just COMMON SENSE



Enthusiasts confine themselves—often at great cost and inconvenience—to one certain material or method of construction, yet in the long run, economy and adequacy will prevail. This point is well illustrated above in the construction of the 20″ mill pinion housing designed by the United Engineering and Foundry Company. To construct it entirely of steel castings would have involved intricate patterns. A completely welded job of rolled steel would have necessitated considerable flame cutting and loss of material. By using both methods, the patterns and castings were simplified; the rolled steel was welded in simple flat surfaces, and the good points of each method were combined in an economical and efficient design.

Try this in your next design—the saving will surprise you.

CARNEGIE STEEL COMPANY

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
PITTSBURGH • PA.

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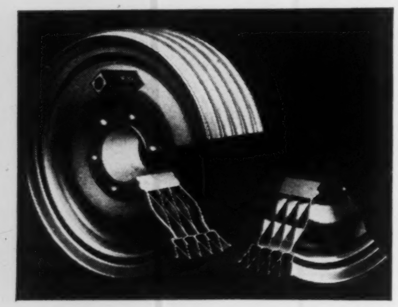
additional follow-up spring at the contacts. Contacts are silver to silver, double break. The mechanism is mounted on a porcelain base and is removable as a unit from the enclosure. This construction does not increase the mounting dimensions which are $2\frac{1}{2}$ inches wide, $4\frac{1}{4}$ high and $2\frac{7}{8}$ deep. This station also is built with dust tight and water tight enclosure.

SQUARE D
MILWAUKEE, WIS.
START
STOP

Contacts of improved push button stations are silver to silver, double break

Larger V-Belt Drives Offered

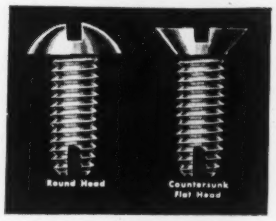
V-BELT drives with one or both sheaves "Texsteel" now are available from $\frac{1}{4}$ to 15 horsepower suitable for many industrial applications, according to a recent announcement of Allis-Chalmers Mfg. Co., Milwaukee. These sheaves, shown herewith, are grid type construction with formed heavy gage steel sections electrically welded at web and rim. Outer rims are rolled for protection, appearance and strength. Integral bushings or solid bored hubs are standard. The sheaves are balanced, light in weight and will withstand severe service. They have an aluminum finish.



Outer rims of new sheaves are rolled for protection, appearance and strength

New Screw Taps Standard Threads

DESIGNED for use in assembly operations which include the fastening of sheet steel, machinery steel, bronze, aluminum, fiber, bakelite, and similar materials, the new self-tapping screw manufactured by Kellogg Switchboard & Supply Co., 1066 West Adams street, Chicago, has a standard thread, balanced flutes and twin cutting edges. The "Tapster," shown herewith, accomplishes a tapping operation as it is driven into the work. It can be retracted and redriven without injury to itself or the threaded hole. As the threads of the screw are standard, lock nuts can be used wherever required, or a screw of standard design can be employed in the threads cut by the self-tapping screw.



Screws can be retracted and redriven without injury to themselves or the threaded hole

Compressed Air Operates Clutches

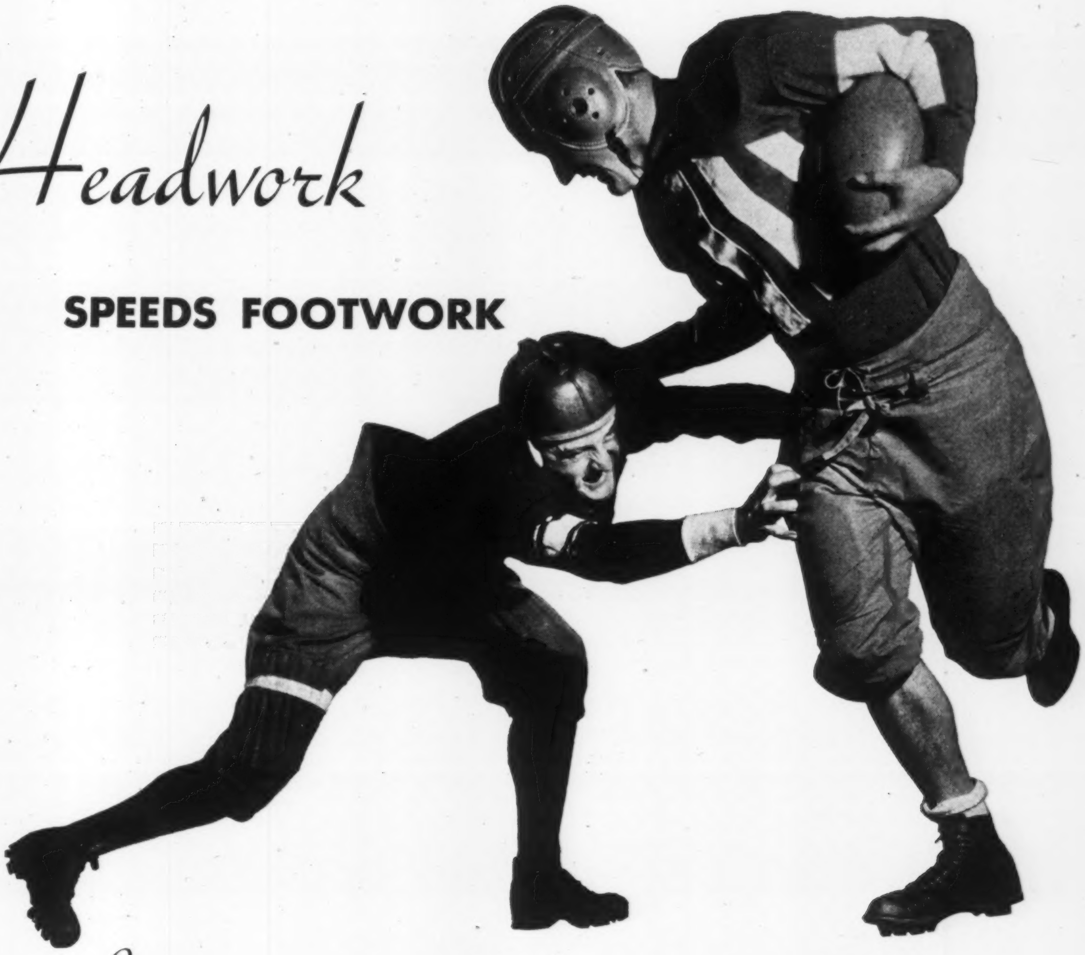
QUICK - ACTING, pneumatically operated clutches for use on forging machines, presses, bulldozers and similar equipment have been brought out by Ajax Mfg. Co., Cleveland. With but slight modification of design, through the substitution of a simple housing instead of the combination flywheel and pulley rim, these clutches, shown herewith, become serviceable for power transmission applications.

The clutches are of the usual multiple-disk friction type, excepting that pressure is applied to the friction surfaces by introducing compressed air behind an annular piston acting directly upon the plates. There are no toggles, wedges, thrust collars, yokes or levers employed to transmit this pressure as it is self-opposed within the housing of the plates. The only operating parts, aside from the piston and the plates, are compression springs for retracting the piston

No toggles, wedges thrust collars, yokes or levers are used in clutch operated by compressed air

Headwork

SPEEDS FOOTWORK



Likewise bearing performance depends largely on application engineering

THE success of New Departure Ball Bearings in hundreds of machines is due in a large measure to the originality and ingenuity of the New Departure engineers who applied them. » » » There are no better bearings in the world than New Departures, yet without New Departure application engineering back of them, they would never have earned the respect they now enjoy. » » » Next time you redesign a machine, remember to go where you buy *performance,* not just bearings. And performance comes only with correct bearing engineering in the installation at hand. The New Departure Manufacturing Company, Bristol, Conn.; Detroit, Chicago.

NEW DEPARTURE

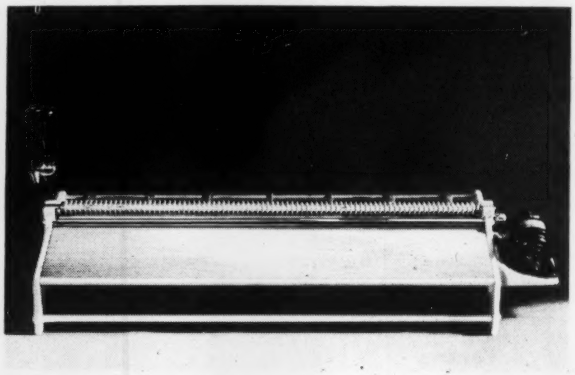
Headquarters for
Bearing Engineering

2058

and disengaging the plates when the air pressure is released. At present these clutches are manufactured in sizes with friction plate diameters of 18, 21, 24 and 30 inches with normal capacities ranging from 100 to 1000 horsepower per 100 revolutions per minute. Larger and smaller sizes will be built on order.

Machine Prints Without Negative

FOR use in making black and white positive prints, Charles Bruning Co., 96 Reade street, New York, has introduced a new developing machine which prints directly, without the use of a negative. This machine, shown herewith, develops prints up to 36 inches in width. In making a black and white positive print from a transparent or translucent subject, the subject is first exposed with the paper in the blueprinting machine exactly as in making a blueprint. The exposed paper then is introduced into the developing machine from which it emerges fully developed. No washing of the print is necessary.

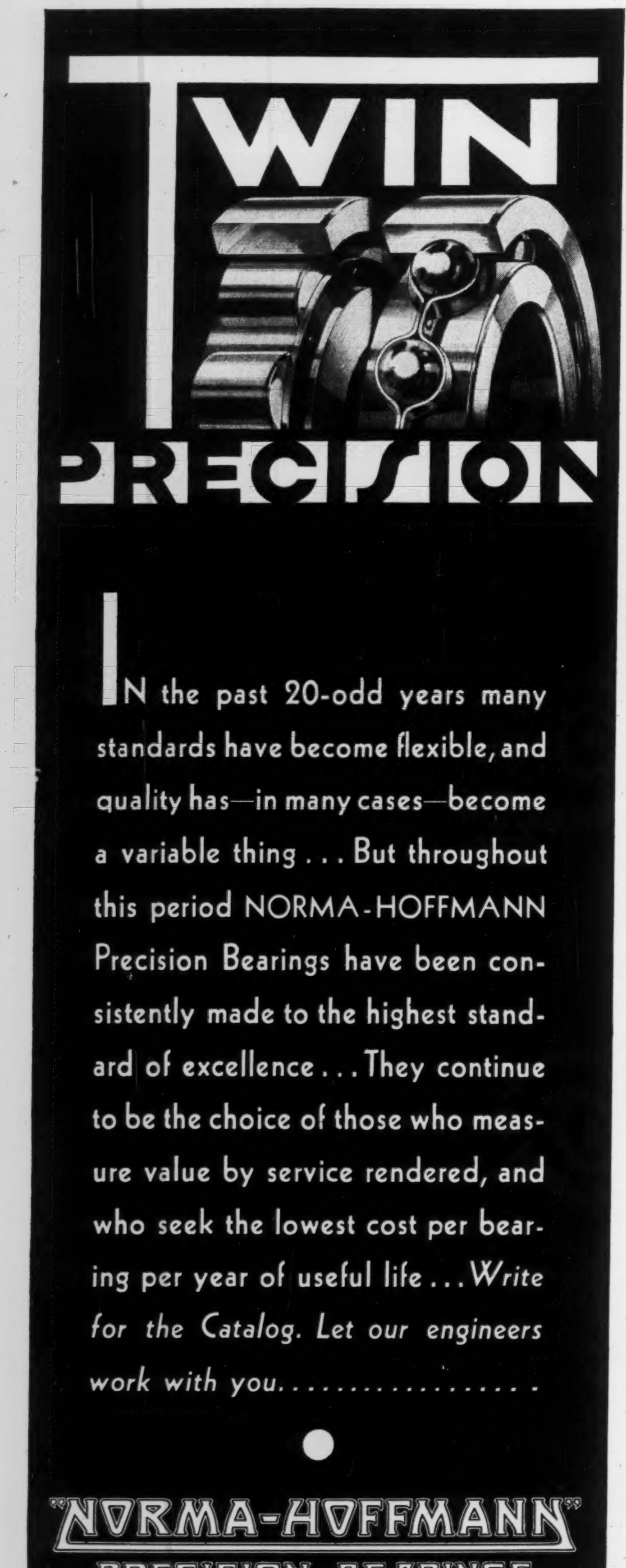


No washing is necessary in producing black and white prints on this machine

Switches Have Overload Protection

SOLENOID operated across-the-line starting switches in a new line have been introduced by Allen-Bradley Co., 1311 South First street, Milwaukee. The switch, shown herewith, is rated at 5 horsepower, 220 volts; 7½ horsepower, 440-550 volts for polyphase motors, and up to 1½ horsepower, 110 volts; 3 horsepower, 220 volts for single phase self-starting motors, and is made in three forms: Form 1, with start and stop pushbuttons; form 2, without pushbuttons, for thermostat or remote pilot control; form 3, with two-way hand-automatic switch for "try-out" control installations.

Two resisto-therm relays with interchangeable thermal elements provide overload protection. The arc hood and switch contacts are self-



TWIN PRECISION

IN the past 20-odd years many standards have become flexible, and quality has—in many cases—become a variable thing . . . But throughout this period NORMA-HOFFMANN Precision Bearings have been consistently made to the highest standard of excellence . . . They continue to be the choice of those who measure value by service rendered, and who seek the lowest cost per bearing per year of useful life . . . *Write for the Catalog. Let our engineers work with you. . . . .*

"NORMA-HOFFMANN"
PRECISION BEARINGS
BALL, ROLLER AND THRUST
NORMA-HOFFMANN BEARINGS CORPORATION,
STAMFORD, CONN., U. S. A.

MODERN MACHINERY CALLS FOR MODERN METALS

THANKS TO NICKEL

THE BASIC INDUSTRIES ARE GETTING LONGER LIFE FROM EQUIPMENT

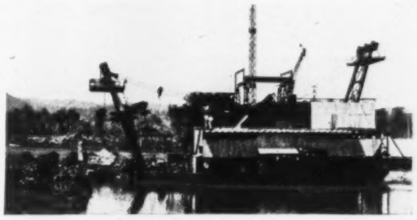
Nowhere is machinery subjected to greater punishment than in wresting raw materials from Nature's vice-like grip. The production of oil, lumber, coal, ores, steel and iron . . . all call for tough, powerful equipment, equipment that stands up under severe conditions of use and abuse.

Time was when no one could tell just how long a machine would last. The buyer installed it and *hoped* for the best. But that was before alloys containing Nickel introduced a new degree of dependability.

Now, thanks to Nickel, alloys of increased dependability are being produced which amazingly add to the life and efficiency of machinery, saving the basic industries millions of dollars every year.

It is rare today to find any type of truly modern equipment that does not contain some moving or highly-stressed parts made of some alloys containing Nickel. For, when correctly alloyed with other metals, Nickel produces a wide range of improved properties that makes these alloys more highly resistant to heat, stress, fatigue, abrasion, corrosion and wear.

Tons and tons of these versatile alloys—Nickel Alloy Steels, Nickel Cast Irons, Nickel Bronzes, Stainless Steels, etc.—are used every year in the basic industries. They are used in the construction of crushers, drills, power shovels, grinding mills, rolling mills, hoists, mine cars and locomotives, trucks and tractors; in pumps, bearings, gears, shafting, valve and pressure castings and in scores of other applications where greater endurance, increased efficiency and low cost operation and maintenance invariably result. When you consider all the advantages of alloying with Nickel, the extra cost is really small in relation to the benefits secured. In many cases only a little Nickel (from ½% to 5%) is required to produce definitely superior mechanical properties.



Ni-Hard

(A NICKEL CAST IRON)

Among the newer alloys containing Nickel is NI-HARD, a dense white iron that is setting unusual records for resistance to wear and abrasion. Extensively used for steel mill rolls, crushing, grinding, pumping and conveying applications. Contains from 4.0% to 6.0% Nickel and 1.0% to 2.5% chromium. Produced either as chilled material or sand cast. Brinell hardness, 600 to 750.

Moreover, these alloys containing Nickel are commercially available in all important metal consuming centers *in a variety of compositions*, each carefully established by exhaustive laboratory tests and field service. If you are planning to build new equipment or modernize the old, they will help you to suit it better to modern operating conditions.

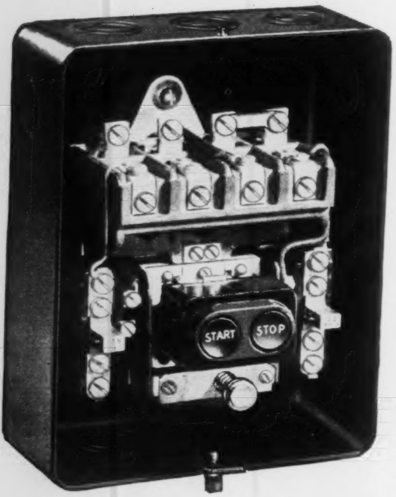
Our engineers have had broad experience in the solution of problems through the use of Nickel. You may feel free to consult them at any time regarding your requirements.

THE INTERNATIONAL NICKEL COMPANY, INC.

Miners, refiners and rollers of Nickel
Sole producers of Monel Metal

67 Wall Street New York, N. Y.

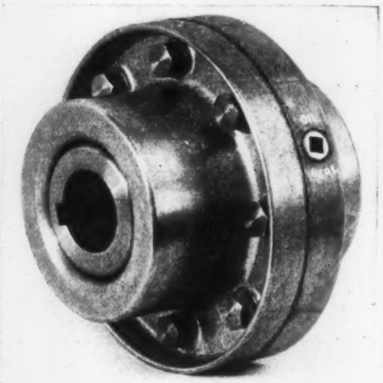
insulated. All switch parts are mounted on a metal back plate. The switching units can be mounted single or in gangs on machine frames or in metal cabinets without further insulation. Rubber grommets between switch mechanisms and baseplate give a full floating mounting which prevents switch noise from being transmitted to and amplified by the starter cabinet. Machine vibrations, therefore, cannot be transmitted back to the switch and interfere with its operation.



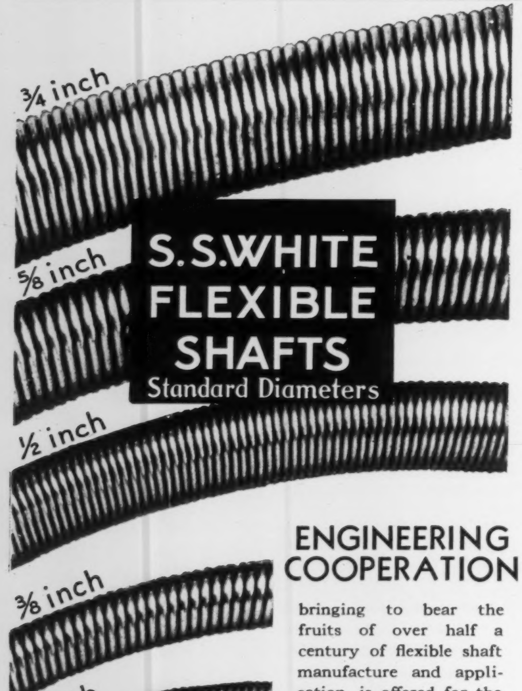
Arc hood and switch contacts on new solenoid operated, across-the-line starting switch are self-insulated. Rubber grommets prevent switch noise from being transmitted to and amplified by the starter cabinet

Announces Light Duty Couplings

DIE-CAST sleeves or casings are employed on the new light-duty Fast's couplings recently introduced by Bartlett Hayward Co., Baltimore. The coupling, shown herewith, follows the design of the larger sizes of the line in other respects in that external and internal gears, permanently in mesh, encased in an oil-filled casing are used. The use of zinc die castings has permitted the economical development of the lighter size. The new couplings are available in sizes from 1 to 2⅛ inches, horsepowers



Die castings are used to provide a line of small geared couplings



ENGINEERING COOPERATION

bringing to bear the fruits of over half a century of flexible shaft manufacture and application, is offered for the working out of specific problems. Let us have the details.

Do you know there are FLEXIBLE SHAFTS available as large as ¾″ in diameter

They're S. S. WHITE Shafts, built up practically solid of layers of the highest grade steel wire — shafts that are strong, reliable and capable of standing up under continuous hard service.

With their higher torque capacities, these shafts greatly enlarge the field of application for the transmission of power around corners and in all other cases where conditions prevent the use of a solid shaft.

In the present day desirability for rock-bottom costs, manufacturers should not overlook the possibility of replacing comparatively complicated and costly transmission elements with the simple, self-contained, easily applied flexible shaft.

Full details about the extensive line of S. S. WHITE Shafts, Casings and Fittings will be supplied on request.

Write for them.

The S. S. WHITE Dental Mfg. Co.
INDUSTRIAL DIVISION
154 West 42nd St. New York, N. Y.

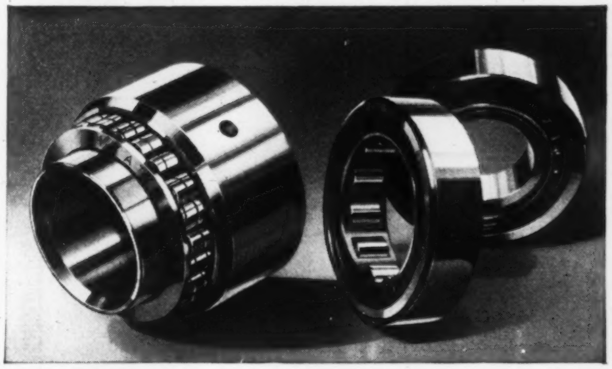
WE SPENT THOSE LEAN YEARS

. . . advancing manufacturing methods

That was a great depression, wasn't it? It depressed some more than others. Many made good use of it—and Hyatt is numbered among the latter.

During those lean years our equipment and production engineers were constantly visiting plants of modern machine builders and machine users. Their job was to find better methods and newer machines—to increase precision, promote accuracy and protect Hyatt quality.

As a result, equipment good only a few years ago was obsoleted to make room for new machines, which we have helped to create for our particular uses. We spent millions during the depression to enhance Hyatt quality and performance—to take care of your bearing requirements. Hyatt Roller Bearing Company, Newark, Detroit, Chicago, Pittsburgh, Oakland.

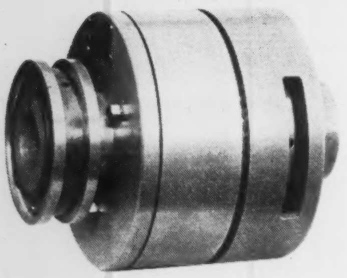


HYATT
ROLLER BEARINGS
PRODUCT OF GENERAL MOTORS

from 2 to 15 per 100 revolutions per minute and a maximum speed of 3600 revolutions per minute.

Introduces Small Magnetic Clutches

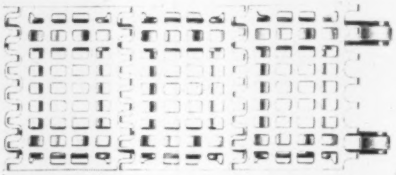
MULTIPLE disk magnetic clutches in new small sizes, 6 inches in diameter and larger, have been announced by Magnetic Mfg. Co., Milwaukee. These clutches, shown herewith, can be used in either wet or dry operations. Their use is permissible in oil, water or any other similar liquid. The style C clutches have high torque capacity with ample friction area. A simple one-point adjustment compensates for lining wear. The clutches are built with from 2 to 8 disks and a complete line of all sizes is available.



A simple one-point adjustment compensates for lining wear on new magnetic clutches

Chain Conveyor Is of Brass

CONVEYOR chains especially designed for conveying hot bottles or similar products, as from molding machines to lehrs or normalizing furnaces have been developed by Link-Belt Co., Chicago. As a certain amount of checking occurs when a hot bottle is transferred to a cold conveyor chain, the new chains employ a grating-type of tray, made of copper, connected to and supported on or from the inner sides of two strands of finished steel roller chain. The principle of this design is that as copper is a better



Checking of hot bottles led to the introduction of brass conveyor chain

Quality for 42 years!

While codes are the talk of the day, Wagner calls attention to its own Code of Quality under which it has operated for 42 years.

Wagner's code of QUALITY was adopted at the time the company was founded—long ago, in 1891. And never has Wagner swerved from its policy of building motors of only the highest quality . . . motors giving continuous, dependable power . . . motors not built to sell at a price, but designed and constructed to give maximum service at minimum cost.

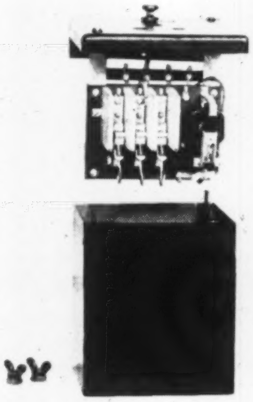
Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, U.S.A.
MOTORS - TRANSFORMERS - FANS - BRAKES

S-533-3A

conductor of heat there should be considerably less checking as compared with handling the bottles on a conveyor chain made either of steel or malleable iron. The standard width of tray is 4¼ inches but other widths of trays can be furnished.

Magnetic Switch Is Oil Immersed

OIL immersed magnetic switches for use in corrosive atmospheres where class I, group D control is not required have been developed by General Electric Co., Schenectady, N. Y. This switch, designated as GR7006, is designed for controlling motors which can be started on full voltages. The equipment, shown herewith, consists of a standard magnetic switch with special coils and special contact tips for operation under oil. The enclosure is a square sheet metal oil tank with a heavy boiler plate top cover.



Magnetic switch and special overload relay are fastened to the cover and extend into the oil

The magnetic switch and a special oil immersed temperature overload relay are fastened to the cover and extend into the oil. The relay can be reset by means of a button projecting through the top cover. The switch is available in the following sizes: 3, 7½ and 15 horsepower at 110 volts; 5, 15 and 30 HP at 220 volts; and 7½, 25 and 50 HP at 440 and 660 volts.

New Small Motors Announced

TWO new types of motors designed for use in applications such as fans, vending machines, display signs, small tools, toys, operating mechanisms, etc., have been introduced by Speedway Mfg. Co., 1834 South Fifty-second avenue, Cicero, Ill. These motors are so small that they fit comfortably in the hand and weigh approximately a pound. They are offered in two forms, a shaded pole type, shown herewith, suitable for operation on 60 cycle alternating current circuits and a universal type operating on

A SET SCREW *that* STAYS SET *even under* VIBRATION!

BRISTO Wrench and Safety Set Screw

WHERE vibration is encountered use BRISTO Set Screws. You can seat them deeper . . . lock them tighter . . . to STAY set. Extra force in setting up a BRISTO can't harm the socket. A unique design removes strain from the sides of the socket . . . prevents the rounding out and splitting that leaves ordinary screws jammed in the holes.

These Screws speed up work, too. The wrench finds its own way into the fluted socket . . . without slipping and fumbling. Neater appearance, longer wear, protection against unauthorized tampering, are other BRISTO advantages. And they are provided by BRISTO Cap Screws as well as BRISTO Set Screws.

To simplify your own work . . . or to improve your product, use these modern screws. They are available in many sizes . . . *several* under ¼ inch. Get some free samples. If you use belt lacing, write for samples of BRISTOL'S Steel Belt Lacing, too.

THE BRISTOL COMPANY, WATERBURY, CONN.

Branch Offices: Akron, Birmingham, Boston, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco

●

You Can Give a BRISTO the Force Needed for a Tight Set . . . Without Damaging It.

Compare* BRISTO *direct turning pressure —with sidewall pressure of other designs

Try BRISTO SCREWS . . . Write for FREE Samples

TRADE MARK
BRISTO
REG. U.S. PAT. OFF.

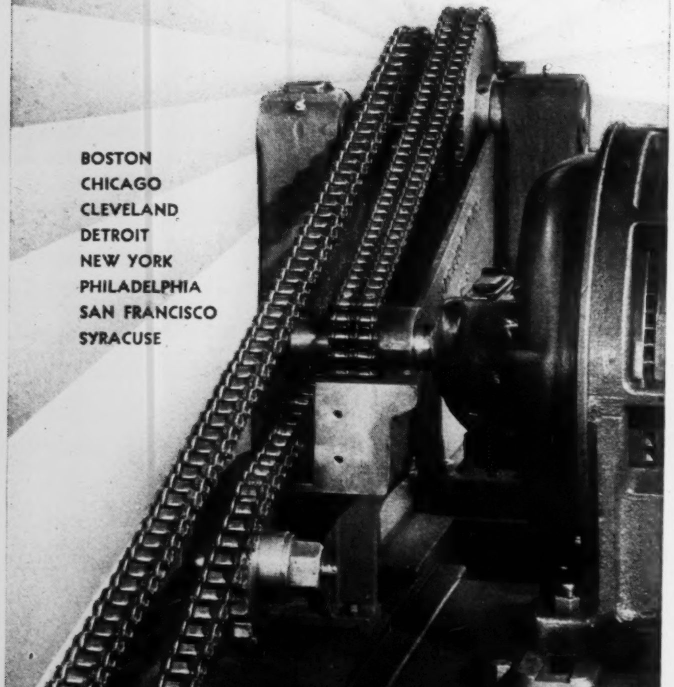
Hollow Safety **SET SCREWS**
Socket Head **CAP SCREWS**

WHITNEY
ROLLER CHAIN
EQUIPPED

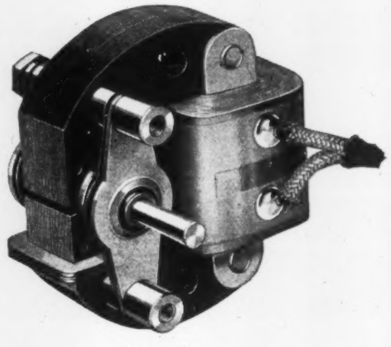
. . . means positive power transmission, plus-lasting efficiency and economy of operation.

THE WHITNEY MFG. CO.
HARTFORD, CONN.

BOSTON
CHICAGO
CLEVELAND
DETROIT
NEW YORK
PHILADELPHIA
SAN FRANCISCO
SYRACUSE



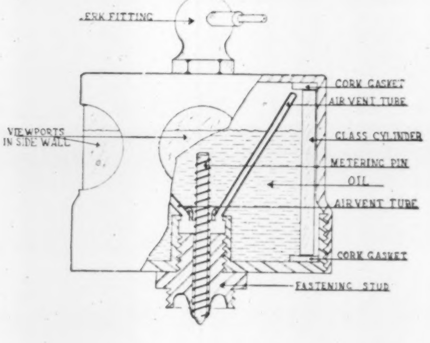
either direct or alternating current. Both motors operate directly from 110 volt circuits, no transformer being required. The skeleton construction of the motors lends itself to incorporation in machines. Each motor is entirely self-contained and equipped with self-aligning, self-lubricating bearings.



Skeleton construction of small motors lends itself to incorporation of the motors in the machine to be driven

Oil Feeder Measures Lubricant

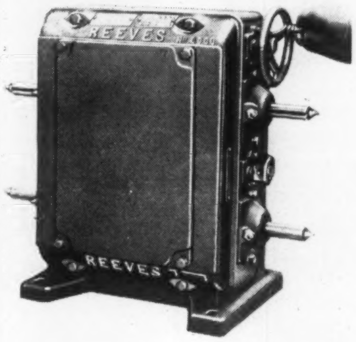
EMPLOYING a method of measuring the oil feed which is a radical departure from conventional methods, the new industrial oiler introduced by Hallanger Oiler Sales, 630 St. Jean avenue, Detroit, can be adjusted for one drop of oil to be delivered per minute, or more or less as desired. The oil capacity of the unit is sufficient for a 10 hour shift, whether oils of 150 to 250 viscosity are used or the lighter oils of 90 to 100 viscosity are employed. The oilers are made of heavy gage steel stampings, the upper shell providing a guard for the glass and the round ports giving ample visibility.



Lubricator which has an oil capacity sufficient for a 10-hour shift measures the lubricant delivered to the bearing

Transmission Is Completely Enclosed

ESPECIALLY designed for upright installations of limited space and low horsespower and applications in which severe conditions of service may be encountered, the new completely enclosed vertical variable speed transmission, now being manufactured by Reeves Pulley Co., Columbus, Ind., is less than 14 inches in overall height. The unit known as No. 0000, shown herewith, has a cast iron case which completely protects the operating parts from water, chemical fumes, abrasives, etc. A system of centralized force-feed lubrication is designed into the unit.



Speed adjustment in infinite stages is available with completely enclosed small unit

The new design provides speed adjustment in infinite stages in ranges of from 2:1 to 6:1. Its capacity is from ⅛ to ⅜ horsepower. Overall width, not including handwheel, is 11¼ inches; thickness, including feet, 7-7/16 inches; net weight 70 pounds.

Protect Right to a Valid Patent!

(*Concluded from Page* 27)

of Patents may call upon the inventor last to file, that is the junior party, to state in writing when he conceived his invention. If the junior party conceived the invention after the senior party had filed, then the junior party loses the right to the patent as his invention is obviously anticipated by the senior party.

Published anticipation includes those cases where the invention was shown or described in a patent or in a publication in this or any foreign country prior to the conception date of the invention in question. To constitute published anticipation it is necessary that the alleged anticipatory patent or publication show or describe a device that is substantially identical in subject matter to the subject matter of the device in question.

Published anticipation should not be confused with the statutory bar of two-year publication even though they overlap each other. For instance, published anticipation and the statutory bar of two-year publication overlap when the published anticipation is published for more than two years prior to the filing date of the subsequent invention. In the event of overlapping the subsequent invention may be invalidated upon the ground of the statutory bar of two-year publication as well as upon the ground of published anticipation.

ADAPTABILITY

The world regards the works of the ancient Greeks as the epitome in culture. Their adaptability and individuality as characterized in the ceremonial vase have given us the inspiration for grace, beauty of design, and shapeliness of outline ››› The modern artist, be he architect, engineer, draftsman or student . . . will better interpret his own ideas of beauty and practicability if he too will individualize his efforts ››› How better to begin than at the beginning . . . in your tracings? The "tooth", transparency, glaze, thickness, and strength of the paper . . . the hardness of your favorite pencil, kind of ink, style of pen, pressure of your hand, all affect the results. And in the many different tracing papers, vellums, and cloths individualized by DIETZGEN surely there is one to fit YOU.

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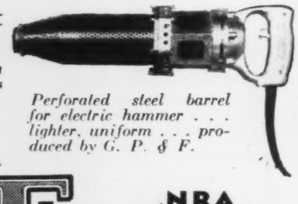

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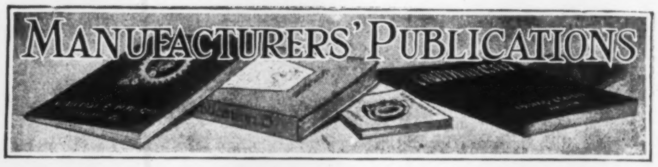
NRA MEMBER U.S. WE DO OUR PART



ALLOYS (STEEL)—Working data and technical facts on Carpenter stainless steels are given in a recent publication of Carpenter Steel Co., Reading, Pa. The bulletin, designed for ready filing, includes a most complete review of the alloys including their physical and chemical properties; considerable general information on the alloys, terms used, and similar points; a table giving a summary of technical data; recommended uses; and application photographs.

ALLOYS (STEEL)—American Rolling Mill Co., Middletown, O., is distributing a booklet on its new line of stainless steel alloys. The composition, properties, characteristic finishes and applications of the alloys are given.

ALUMINUM—The riveting of aluminum and its alloys is covered in a well-prepared booklet of Aluminum Co. of America, Pittsburgh, which includes data on the strength of riveted joints, driving procedure for riveted joints, selection of rivet alloy and aircraft riveting, as well as as tables of engineering data.

BEARINGS—Engineering information sheet No. 206 FE of New Departure Mfg. Co., Bristol, Conn., presents the application of ball bearings to vertical woodworking spindles and the lubrication system used on these spindles.

BEARINGS—Johnson Bronze Co., New Castle, Pa., is now publishing a most comprehensive handbook on alloys having physical characteristics that make them efficient bearing metals. The metals treated will include plain cast bronze, rolled sheet bronze, graphited bronze, laminated bronze and laminated steel, the relative merit of each alloy being described. Selection of the bearing, bearing lubrication, reference tables and engineering charts, and a listing of some 2000 bearing or bushing sizes will be included.

COMPOSITION MATERIALS—General Electric Co., West Lynn, Mass., is distributing a most complete booklet, GEA-937C, on its line of plastic products, textolite laminated, textolite molded and cetec. The booklet discusses the various products, gives their applications, includes excellent photographs of parts made from these materials and presents tables of properties of the materials.

CONDUIT—Bulletin CA-502, prepared by Switch & Panel Division, Square D Co., Detroit, gives complete information on Square-Duct, the company's rigid suspension method for wiring.

COUPLINGS—Bartlett Hayward Co., Baltimore, Md., has prepared a leaflet on its new light duty type self-aligning coupling. A cross sectional view, dimensions and capacities are given.

COUPLINGS—Farrel-Birmingham Co. Inc., Buffalo, has prepared bulletin No. 437 which gives a complete description of the company's line of Gearflex couplings. The bulletin includes illustrations which show all details of these flexible couplings, diagrams and tables of ratings, dimensions and weights.

DIE CASTINGS—Recent bulletins of Aurora Metal Co. Inc., Aurora, Ill., illustrate and explain the specification of parts designed to meet present day requirements, parts made by die casting and requiring little machining and finishing.

DIE CASTINGS—Planning, designing, making, and selling for profit through the use of zinc die castings is comprehensively presented in a well-prepared booklet of New Jersey Zinc Co., New York. The booklet includes a general discussion of the problem, the properties of zinc die castings, a discussion of the designer's influence on selling, and descriptions and attractive photographs of many types of die casting applications.

FLOOR PLATES—Inland Steel Co., Chicago, has published a folder on its 4-way floor plate, suitable for use as steps and walkways on machines.

GEARS—Laminated bakelite as a silent stabilized gear material is presented in chart form by Synthane Corp., Oaks, Pa. The chart gives properties and machining instructions for the material, gear outlines, formulas for computing horsepower of the gears, and all other data pertinent to the specification of gears from this material.

INSTRUMENTS—Brown Instrument Co., Philadelphia, has just published a catalog, No. 6702, on its new thermometer and pressure gage line, available in indicating, recording and controlling types. The catalog includes, in addition to descriptions of the units, typical applications in representative industries.

LUBRICATION AND LUBRICATING EQUIPMENT—Controlled lubrication in antifriction bearing design is covered completely in an article in the September issue of *Lubrication*, published by Texas Co., New York. Function of lubrication, lubrication charts, constructional features, importance of lubricant seals and application of lubricants is given.

LUBRICATION AND LUBRICATING EQUIPMENT—The importance of colloidal-graphited lubricants in "running-in" operations is covered in technical bulletin No. 113.5 of Acheson Oildag Co., Port Huron, Mich. The bulletin discusses the necessity of the running-in operation on new machines and how this operation is necessary to the performance of the machines.

MOTORS—Small shaded pole and universal motors suitable for use with fans, small tools, vending machines and similar applications are presented in two leaflets recently prepared by Speedway Mfg. Co., Cicero, Ill.

SHAPES—As a supplement to *Pocket Companion*, Carnegie Steel Co., Pittsburgh, has published a booklet showing the properties and all essential detail dimensions of a modified "CB" series. This series of shapes will be available April 1, 1934.

STEEL (METAL-CLAD)—Mild carbon steel clad with stainless is described in a bulletin of Ingersoll Steel & Disc Co., Chicago, which gives application photographs, production information and similar data.

TEMPERATURE CONTROLS—Edwin L. Wiegand Co., Pittsburgh, has prepared bulletin TA-120 describing its line of

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NOW you can improve the performance of your product and save money, too! Shakeproof will show you how to eliminate the need for lock washers by building the Shakeproof locking principle right into your standard parts. You can have the twisted teeth of Shakeproof protecting every vital connection just as if you had used a Shakeproof Lock Washer separately. Because each twisted tooth bites into both nut and work surfaces, you can rest assured there will be no movement of the part regardless of how great the vibration. It will pay you to discuss this idea with a Shakeproof Engineer—hear how easy it will be for you to cut costs and improve your product by this new method. No obligation—write today

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In every detail of their construction Dumore Fractional Horse Power Universal Motors are the finest available. They can be supplied in any size up to ¾ H. P. and can be adapted to a wide variety of applications. Regardless of what your requirements may be, ask for technical data regarding the construction and performance of Dumore motors before deciding.

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BRUNING

devices for indicating and controlling temperatures in tanks, machines, hydraulic press platens, ovens and furnaces and other equipment.

THERMOSTATS—Bearing thermostats designed for protection of motor-driven and other types of rotating machinery from breakdowns due to overheated bearings are described in leaflet 1120 of Electric Controller & Mfg. Co., Cleveland.

WELDED PARTS AND EQUIPMENT—Aluminum Co. of America, Pittsburgh, is distributing an attractive booklet on the welding of aluminum and its alloys. This booklet discusses the various types of welding as applied to this material, effect of expansion and contraction, strength of welded joints and similar information.

Research Publications

Zinc in Relation to General and Industrial Hygiene, by Cecil K. Drinker, M. D., and Lawrence T. Fairhall, Ph. D. This reprint of an article which appeared in the August 11 issue of *Public Health Reports* published by United States Public Health Service, contains a comprehensive discussion of the question of the desirability of zinc in foods and drinking water. The material is subdivided into topics such as zinc in relation to the health of the public and zinc in relation to industrial hygiene. Of special interest to manufacturers of machines for handling food products which incorporate zinc parts, the reprint includes a summary that recommends that the limit on zinc in drinking water be increased or done away with altogether. Available through New Jersey Zinc Co., 160 Front street, New York, 7 pp.

The Structure of Carbon Steel at Elevated Temperatures and Under Reduced Pressure, by H. E. Publow and T. D. Parker. Results of these investigations indicate that the surface of a specimen of polished steel after being heated and cooled to temperatures above the critical range shows evidence of buckling. This buckling is believed to be the result of a volume change occurring when the iron changes from one allotropic form to another. A surface configuration was present to which various names such as "Heat etching," "Heat relief," and "Vacuum etching" have been applied. Specimens cooled from above the upper critical temperature show two networks or grain structures, one superimposed upon the other. Published as bulletin No. 53 by Michigan Engineering Experiment Station, Michigan State College, East Lansing, Mich. 14 pp. 25 cents.

Riding Comfort Analysis, by H. M. Jacklin and G. J. Liddell. The progress of two related investigations, Measurement of Vibrations in Vehicles, and Effects of Vibration on Humans, which have been carried on concurrently are presented in this bulletin and the results obtained are combined into a method for numerically evaluating riding comfort. Analytical and graphical methods for applying the results of tests to evaluation of vehicles are explained and a set of charts has been constructed to give accurate results in the analysis of accelerometer records. Appendices include a comprehensive bibliography on methods of measuring vibrations and their effects on humans, and condensed reports of some additional investigations bearing on the general subject of riding comfort. Published as research series No. 44, engineering experiment station, Purdue University, Lafayette, Ind. 146 pp. $1.

Men of Machines

(*Concluded from Page 44*)

cancy created by the appointment of Dr. L. J. Briggs to the directorship of the bureau last June.

* * *

E. D. Campbell recently was made assistant general mechanical engineer, American Car & Foundry Co., with headquarters at Berwick, Pa. He will be succeeded as head of the engineering department in St. Louis by Allen W. Clarke, formerly of the Jeffersonville, Ind., plant.

* * *

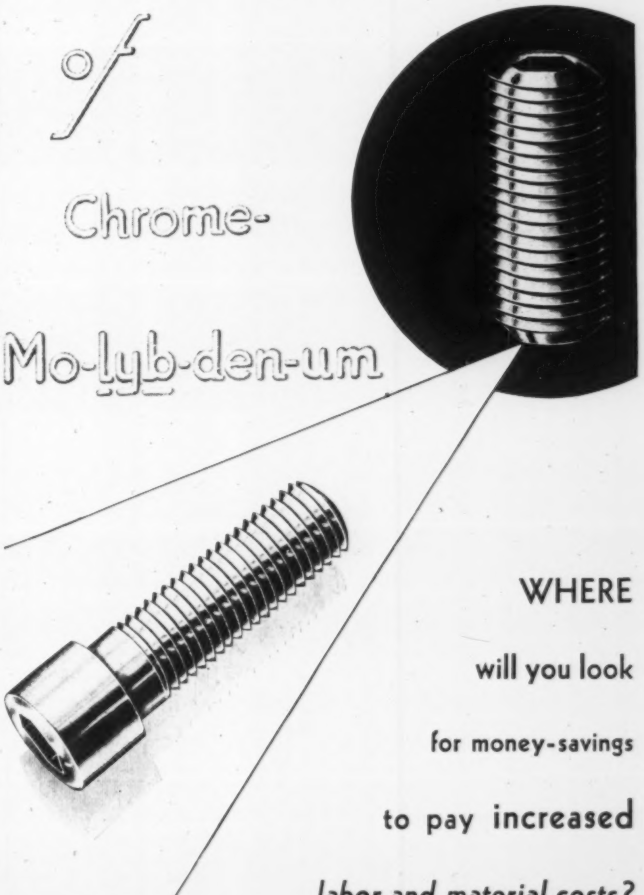
Franklin G. Smith, president of Osborn Mfg. Co., Cleveland, has been elected director of the Foundry Equipment Manufacturers association.

* * *

LeRoi J. Williams, vice president and general manager, Grigsby-Grunow Co., Chicago, and director of the Radio Manufacturers association, has been made chairman of the engineering committee of that group. He will direct engineering activities of the organization, succeeding George K. Throckmorton, resigned.

Obituary

CHARLES PIEZ, chairman of the board, Link-Belt Co., Chicago and past president of the American Society of Mechanical Engineers died recently at Washington at the age of 67. Born in Germany of naturalized American parents, Mr. Piez received his technical education as a mining engineer at the school of mines, Columbia university. Immediately after he was graduated in 1889, he entered the employ of the Link-Belt Engineering Co., Philadelphia, as an engineer-draftsman. After he had attained the position of chief engineer and general manager of the Philadelphia works of that concern, he 17 years later was elected president of the consolidated Link-Belt organization.



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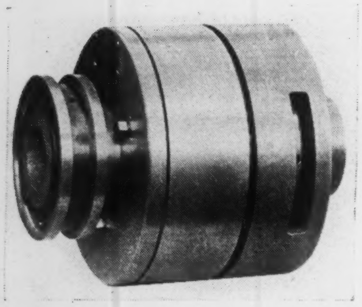

THESE new Stearns Multiple Disc Magnetic Clutches are the first of their type, as far as we have discovered, having the unique property of completely successful operation immersed in oil, water, or other liquid, where conditions may require it.

Available in sizes from 6" diameter upward, 2 to 8 discs; all completely impregnated against moisture. Possess all advantages of larger clutches: high torque, ample friction area, cool operation, simple one point adjustment; provide smooth control and acceleration, low maintenance and operating costs. Collector rings, brush-holders and brushes supplied as part of the clutch.

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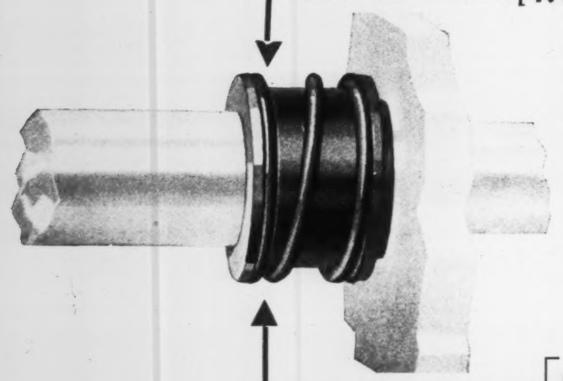

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[ROTATES WITH THE SHAFT]

BUSINESS AND SALES BRIEFS

WALLACE A. COUSINS has joined Louis Allis Co., Milwaukee, as representative in the state of Delaware and District of Columbia, with headquarters at 4402 Kathland avenue, Baltimore. Charles F. Norton, former vice president and general manager of Howell Electric Motors Co. is now affiliated with the Louis Allis company in an executive sales capacity.

* * *

Charles A. Colgate has been appointed Pittsburgh representative for Roller Bearing Corp. of America, Trenton, N. J. He has previously been associated with Jones & Laughlin Steel Co. and with Mesta Machine Co.

* * *

George W. Wagstaff has joined the alloy steel sales force of Youngstown Sheet & Tube Co., and is located in the company's Chicago office.

* * *

Edwin H. Kottnauer of Los Angeles has been appointed by Climax Molybdenum Co. as its representative for the Pacific Coast territory. The company's office and warehouse are located at 1341 South Hope street, Los Angeles.

* * *

J. P. Butterfield is now in charge of the stainless steel sales department recently created by American Rolling Mill Co., Middletown, O. Mr. Butterfield, formerly manager of the Armco development department, will be assisted by E. E. Jones.

* * *

The electrical and electronic developments and products of C. F. Burgess Laboratories Inc., have been moved from their former location in New York to Freeport, Ill., in which locality all sales and manufacturing of the organization will be conducted.

* * *

W. K. Leach, formerly with General Alloys Co., Boston, is now associated with American Manganese Steel Co., Chicago Heights, Ill., as general manager of the alloy division. Mr. Leach is located at the plant of the manganese steel company at 6600 Ridge avenue, St. Louis.

* * *

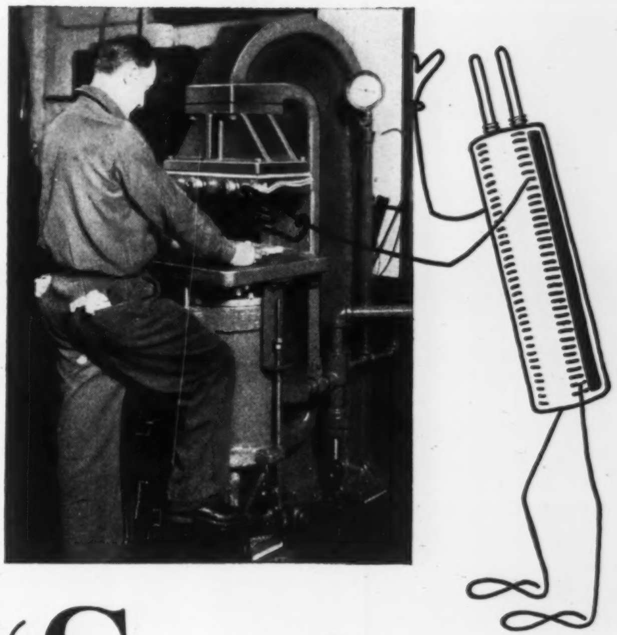
Falk Corp., Milwaukee, is now represented in the Dallas, Texas, territory by T. F. Scannell, who has been the company's St. Louis representative for several years. Mr. Scannell's office is located at 1410 Magnolia building. Fitch S. Bosworth will represent the company in the St. Louis territory with offices at 5475 Cabanne avenue.

* * *

D. Augsburger has been appointed manager in charge of the Duriron company's Boston office, 1255 Little building, 80 Boylston street. He was formerly located at the company's plant and general offices in Dayton, O. E. D. Brauns, who was in charge of the Boston office, has been transferred to Philadelphia, 1505 Race street. Mr. Brauns previously was in the company's engineering department and general sales office in Dayton.

* * *

H. H. Blakeslee, formerly assistant manager of the New Orleans office of General Electric Co., has been appointed manager of the office to succeed B. Willard, who is retiring on pension. J. W. Hicklin, heretofore manager of the Richmond office of the company, has been made manager of the Baltimore office, succeeding G. H. Gilbert. H. V. Whitney, formerly in charge of the general sales, territorial and building equipment sections of the industrial department in Atlantic division of the company, has been appointed manager of the Richmond office, a suboffice of the Baltimore office.



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SIX "SPOTS"—G-E cartridge heating units—heat the platens in this wood-embossing press made by Chas. F. Elmes Engineering Works, Chicago. Correct temperature is absolutely essential. The wood must not be scorched. The heaters are operated in three circuits, each controlled by a G-E 3-heat snap switch—"an ideal arrangement," says the user.

G-E "spots" of heat simplified the design of this machine, provided quick heating and easy servicing.

You may not make or use a press, but "Spot," "Strip," and "Dip"—the G-E midget heating units—will solve dozens of fussy heating problems for you. They are priced as low as $1.75. Send this coupon to your power company for a copy of our free mail-order catalog which describes, illustrates, and prices the complete line of small G-E heating units and devices, or write General Electric, Dept. 6-201, Schenectady, N. Y.

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